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SALMON
IN THE BALTIC PRECINCTS.

BY

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Technical Terms.

The following technical terms are used in this report:

Parr: young fish from the fry stage till they become *smolts* at migration.
Grilse: young salmon returning after only one year spent in the sea.
Maiden fish are those, whether males or females, which have not spawned.
Kelts: fish, that have spawned and are returning to the sea.
Mended kelts: kelts that have fully recovered after spawning.

In describing age, *years* are usually confined to the period before migration and to the total age reckoned from hatching; *winter* to the period after migration, though it may include repeated visits to fresh water. Thus a 1-winter fish is one in its second summer after migration.

In the notification employed in the tables, and occasionally elsewhere, a figure followed by a full-stop denotes years of parr life; a figure, if any, after the stop, years of maiden post-migration life; G is spawning mark; + denotes a period of time to be added less than one year. Thus: 2· is a 2-year old smolt; 2·1 + is a maiden adult salmon with two parr years and about one and a half post-migration years.

Introduction.

EVER since 1890 salmon has been an object of research on the part of international deep sea investigation. At the beginning of the ntury a number of valuable publications were ade on the biology of this fish especially by Nordqvist, Trybom, Henking and hansen. The most exhaustive studies however re made in Norway (Dahl, Landmark) d England (Hutton, Menzies etc.) and so in Sweden (Rosén and Alm). By means earlier and later markings (Järvi, Alm), rough the hook-finds and the work of Willer d Quednau on this subject, through investigans respecting the Gothland salmon by Hessle d through my subsequent work relating to the riations in the Baltic salmon-fisheries it has en possible to determine that, as regards salmon d salmon fishery, the Baltic and its tributary lmon rivers can be considered as one unit. We erefore arrive at the conclusion that all questions lating to salmon within this district should be nsidered under one head.

Trybom already put forward certain proosals for research work on a unified basis and nilar views have since been put forward at rious meetings of the International Council and so by myself in a work published in 1927. rther results have been arrived at through more cal investigations and have lately been published Johansen and Jacobsen, Henking, iller and Quednau, and Dixon, but a nsecutive survey of the Baltic salmon is still to undertaken.

In order to find necessary points for such ntralization I have, during a number of years, vestigated the biology of salmon in most of the vedish rivers not formerly explored as well as e more important fishery districts in the sea, ore especially off Scania and Blekinge and rtain parts of Norrland. The result of these vestigations, and information gathered from other sources, is that it seems possible to form, to a certain degree, a general opinion of the biology of the salmon in the Baltic as also to put forward certain suggestions for the continuation of these researches.

What in the first place it seemed necessary to answer were the following questions:

1) At what period do salmon emigrate from and re-enter the different Swedish and other Baltic rivers and what is the cause of these movements?

2) How is the growth and size of salmon retarded in different rivers and for what cause?

3) What is the cause of similarity, as well as the reverse, in the fishing returns in different parts of the Baltic?

4) What constitute the migrations of salmon in the Baltic and where do salmon go during their sea life when leaving their different rivers and how does this effect salmon of various ages?

5) The connection between salmon in different parts of the Baltic and the practical results that can be inferred therefrom and cause further development of the fishery.

I propose in the following report to give the results of my investigations in order to assist in clarifying these questions.

The material for investigation consists entirely of scales, collected from 1925—1933, obtained from 5,249 salmon of which 2,597 are river fish and 2,652 sea fish (Table 1). As regards the material collected it should be stated that these samples were in no way selected and were obtained during the whole fishing season. In the river the

Table 1. Number of specimens investigated.

Caught	No.	Collected in:								
in river:		1925	1926	1927	1928	1929	1930	1931	1932	1933
Kalix	205	—	—	—	46	56	50	53	—	—
Lule	171	—	—	—	17	44	81	29	—	—
Ume	155	—	—	—	—	—	111	44	—	—
Ångerman	480	20	91	87	102	—	—	180	—	—
Indal	390	—	—	108	134	53	—	77	18	—
Ljung	64	—	34	30	—	—	—	—	—	—
Ljusne	436	—	92	96	—	91	45	70	42	—
Dal	228	—	—	—	98	25	67	38	—	—
Mörrum	468	—	99	133	98	54	—	17	67	—
off the coast of										
Västerbotten	763	—	—	—	—	—	77	505	181	—
Västernorrland	202	—	—	—	—	—	40	148	14	—
Gävleborg	89	—	—	—	—	—	29	19	41	—
Uppsala	18	—	—	—	—	—	—	18	—	—
Gotland	154	—	—	—	—	—	—	—	154	—
Kalmar	24	—	—	—	—	—	—	—	—	24
Blekinge	269	44	99	—	—	—	—	126	—	—
Kristianstad	231	—	—	—	—	—	—	—	139	92
Malmöhus	760	—	—	—	—	119	191	233	150	67
Bornholm	142	—	—	—	—	—	—	—	142	—
Total	5.249	64	415	454	495	442	691	1557	948	183

salmon ascend during most of the summer and in greatest quantity during midsummer, except in the Mörrum river where the greater quantity enter during the months of May and June. As regards salmon caught in the sea, these are mostly found off the Norrland coast during the spring and early summer although some are also caught later and as late as autumn. On the mid-coast salmon fishing plays a very minor part and takes place almost entirely in the spring. In the more southerly provinces fishing takes place in spring and in the autumn and sometimes even in winter; no salmon fishing taking place here during the summer. These different seasons had to be taken into a count when collecting the information in questio

Age has been calculated, as mentioned abo entirely by scales. Specially unclear or otherwi unsatisfactory scales have been omitted. As regar first migration to the sea and the resultant grow of the fish, this growth has been considered commence in the spring or early summer and each case the growth increment has been reckon to begin with a new year of life. As to lengt the longest measurement has been used as p viously agreed by the International Council.

Stockholm, in April 1934.

I.

Age, growth, size, spawning etc. in different Baltic Rivers.

Distribution as to sex.

TABLE 2 shows the number of male and female fish caught entering the rivers for first spawning. It has not always been ɔssible to determine the sex, and thus the entire aterial is not included in these figures. It is ɔssible that the males without hook formation on e lower jaw may have been taken for females. ıe main result should, however, not be affected any greater extent. It is certain that, on the ıole, females form $^2/_3$ of the total salmon entering e rivers. This varies however according to river. the middle rivers the percentage of females is rger than either in the more northern or more uthern streams. In the river Mörrum the sexes e found to be about equally divided. This rying sex distribution is probably characteristic r the different rivers' salmon tribes.

Table 2. Percentage (and number) of males and females from various salmon rivers.

ver	♂♂ %	♂♂ No.	♀♀ %	♀♀ No.
ılix	43.4	(82)	56.6	(107)
le	41.0	(66)	59.0	(95)
ne	36.2	(54)	63.8	(95)
ıgerman	29.7	(125)	70.3	(296)
dal	28.3	(95)	71.7	(241)
usne	23.2	(83)	76.8	(274)
l	31.0	(66)	69.0	(147)
örrum	49.8	(194)	50.2	(196)
ɔtal	34.5	(765)	65.5	(1451)

Age of smolts.

Whilst the first migration to the sea occurs ɔstly: from the Rhine in the first year, from the ıdenaa in Denmark and the British rivers in the ɔond, in the rivers of Norrland and North Norway generally occurs in the third and fourth year of e. Table 3 shows the age of smolts in the dif- rent Swedish rivers which appears to show a neral tendency to become higher in rivers situ- ed at a more northerly latitude. Whilst for stance in the Mörrum river a number of fish .5 %) migrate at the age of one, the majority 0 %) at the age of two and about 12 % at e age of three years, the Ljusne shows an even stribution between fish of 2 and 3 years of age 0.9 % and 47.5 %) whilst in the Kalix the major part (68 %) migrate at the age of 3, about 19.5 % at the age of 4, and some 11.5 % only at the age of 2 years. In the same river the percentage varies somewhat in different years, but there is no definite similarity between different rivers neither is there any tendency towards a definite raising or lowering of the age of smolts in any given year.

Table 4 shows the smolt age divided according to sexes, which seems to be, with a few exceptions, somewhat lower in the case of males than females, 2-year smolt being more common amongst the former. In the rivers where many smolts migrate at the age of four the number of similar migrants is more common amongst males than amongst females. The latter observe a more uniform age at migration, the former a more varied one. The average is on the whole somewhat lower amongst males.

After comparison with the figures, given by Rosén, relating to the age at migration in the Kalix and Lule rivers for the year 1915—1916, we found these figures to be higher than mine, namely

River	2	3	4	5 years
Kalix	3.3 % (1)	53.3 % (16)	43.4 % (13)	—
Lule	9.0 % (16)	49.7 % (88)	39.0 % (69)	2.3 % (4)

It is impossible to control whether migration during the last 10 to 15 years has fallen off regularly or not there being no statistics for the intervening years. In the same way, by comparison with Rosén's figures, it would appear that the age of smolts in the river Ume has risen. Rosén considers these figures to be: 2-years 54.1 % (79), 3-years 43.2 % (63) and 4-years 2.7 % (4). In this connection it should be mentioned that Hutton can show, during a successive number of years, a decreasing of smolt age in the river Wye in England, without being able to discover any reason for it. The mean figures for Rosén's and my collective statistics are as follows:

River	2	3	4	5 years
Kalix	10.5 % (24)	66.4 % (152)	22.7 % (52)	0.4 % (1)
Lule	13.0 % (44)	59.4 % (201)	26.4 % (89)	1.2 % (4)
Ume	42.0 % (124)	54.6 % (161)	3.4 % (10)	—

The attached diagram, Fig. 1, shows clearly the increasing migration age as one proceeds northwards. Here as well as in later calculations,

Table 3. Percentage (and number) of 1 to 5-year smolts.

River	Year	Number of river-years 1. % (No.)	2. % (No.)	3. % (No.)	4. % (No.)	5. % (No.)	No. of specimens investigated
Kalix	1928	—	13.0 (6)	71.8 (33)	15.2 (7)	—	46
—	1929	—	5.7 (3)	67.9 (36)	26.4 (14)	—	53
—	1930	—	16.0 (8)	62.0 (31)	22.0 (11)	—	50
—	1931	—	12.0 (6)	72.0 (36)	14.0 (7)	2.0 (1)	50
	Mean	—	11.6 (23)	68.3 (136)	19.6 (39)	0.5 (1)	199
Lule	1928	—	6.3 (1)	81.2 (13)	12.5 (2)	—	16
—	1929	—	13.9 (5)	63.9 (23)	22.2 (8)	—	36
—	1930	—	17.3 (14)	70.4 (57)	12.3 (10)	—	81
—	1931	—	28.6 (8)	71.4 (20)	—	—	28
	Mean	—	17.4 (28)	70.2 (113)	12.4 (20)	—	161
Ume	1930	—	33.6 (36)	63.6 (68)	2.8 (3)	—	107
—	1931	—	21.4 (9)	71.5 (30)	7.1 (3)	—	42
	Mean	—	30.2 (45)	65.8 (98)	4.0 (6)	—	149
Ångerman	1925	—	13.3 (2)	80.0 (12)	6.7 (1)	—	15
—	1926	—	35.4 (29)	62.2 (51)	2.4 (2)	—	82
—	1927	—	26.5 (22)	72.3 (60)	1.2 (1)	—	83
—	1928	—	35.7 (35)	60.2 (59)	4.1 (4)	—	98
—	1931	—	34.8 (55)	65.2 (103)	—	—	158
	Mean	—	32.8 (143)	65.3 (285)	1.9 (8)	—	436
Indal	1927	—	42.6 (40)	56.3 (53)	1.1 (1)	—	94
—	1928	—	38.7 (48)	60.5 (75)	0.8 (1)	—	124
—	1929	—	34.0 (16)	63.9 (30)	2.1 (1)	—	47
—	1931	—	43.7 (31)	56.3 (40)	—	—	71
—	1932	—	35.7 (5)	57.1 (8)	7.2 (1)	—	14
	Mean	—	40.0 (140)	58.9 (206)	1.1 (4)	—	350
Ljung	1926	—	64.0 (16)	36.0 (9)	—	—	25
—	1927	—	62.1 (18)	37.9 (11)	—	—	29
	Mean	—	63.0 (34)	37.0 (20)	—	—	54
Ljusne	1926	—	51.2 (42)	45.2 (37)	3.6 (3)	—	82
—	1927	—	56.3 (49)	43.7 (38)	—	—	87
—	1929	—	46.3 (38)	51.2 (42)	2.5 (2)	—	82
—	1930	—	58.1 (25)	41.9 (18)	—	—	43
—	1931	—	47.6 (30)	52.4 (33)	—	—	63
—	1932	—	42.9 (12)	53.5 (15)	3.6 (1)	—	28
	Mean	—	50.9 (196)	47.5 (183)	1.6 (6)	—	385
Dal	1928	—	67.4 (64)	31.5 (30)	1.1 (1)	—	95
—	1929	—	70.0 (14)	30.0 (6)	—	—	20
—	1930	—	55.6 (35)	42.8 (27)	1.6 (1)	—	63
—	1931	—	60.0 (21)	40.0 (14)	—	—	35
	Mean	—	62.9 (134)	36.2 (77)	0.9 (2)	—	213
Mörrum	1926	2.1 (2)	85.4 (82)	12.5 (12)	—	—	96
—	1927	12.2 (16)	77.9 (102)	9.9 (13)	—	—	131
—	1928	7.4 (7)	77.7 (73)	14.9 (14)	—	—	94
—	1929	15.1 (8)	75.5 (40)	9.4 (5)	—	—	53
—	1931	—	87.5 (14)	12.5 (2)	—	—	16
—	1932	1.5 (1)	83.1 (54)	15.4 (10)	—	—	65
	Mean	7.5 (34)	80.2 (365)	12.3 (56)	—	—	455

Table 4. Percentage distribution (and number) as to males and females of 1 to 5-year smolts.

	Males				Females				
	1·	2·	3·	4·	1·	2·	3·	4·	5·
	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)
x	—	14.6 (12)	65.9 (54)	19.5 (16)	—	10.4 (11)	68.8 (73)	19.8 (21)	0.9 (1)
.....	—	22.7 (15)	57.6 (38)	19.7 (13)	—	12.6 (12)	75.8 (72)	11.6 (11)	—
.....	—	27.8 (15)	64.8 (35)	7.4 (4)	—	31.6 (30)	66.3 (63)	2.1 (2)	—
erman ...	—	36.8 (46)	62.4 (78)	0.8 (1)	—	32.1 (95)	65.9 (195)	2.0 (6)	—
l	—	46.3 (44)	53.7 (51)	—	—	37.8 (91)	61.0 (147)	1.2 (3)	—
ne	—	60.2 (50)	37.4 (31)	2.4 (2)	—	48.9 (134)	50.0 (137)	1.1 (3)	—
.....	—	66.7 (44)	33.3 (22)	—	—	61.2 (90)	37.4 (55)	1.4 (2)	—
rum	7.7 (15)	78.9 (153)	13.4 (26)	—	9.2 (18)	80.6 (158)	10.2 (20)	—	—

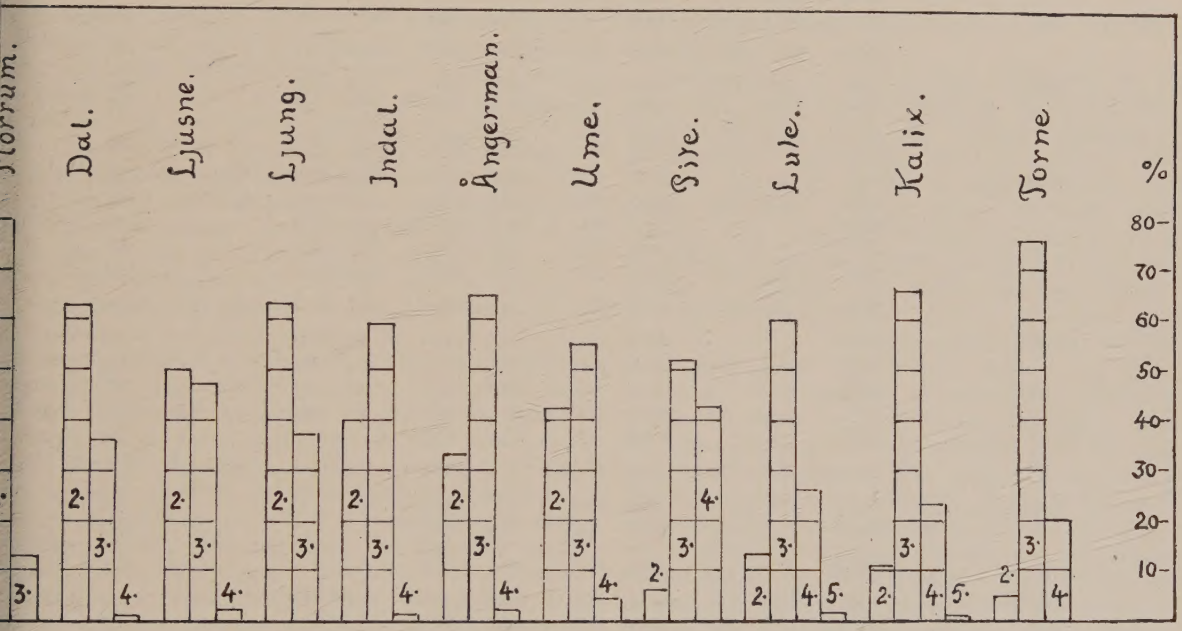

Fig. 1. Percentage distribution as to smolt age for various Swedish rivers.

mean figure of Rosén's and my statistics been taken for the Lule, Ume and Kalix, and the Torne and Pite rivers Rosén's figures , though statistics from the latter rivers are few.

From the Persante, which flows out on the neranian coast Henking states the more l age of smolts to be one to two years. For Vistula there are records relating to sea trout and, according to Dixon, the figures are 2-years 79 0/0 and 3-years 21 0/0. This is for trout a very low age level, whence it may be cluded that the same applies to salmon i. e. they migrate early.

From other Baltic rivers there are no printed unts of the smolt age. As however the rising at migration, as shown above, is common to the Norwegian river smolt (Dahl) there would seem to be strong evidence that the same age would be applicable to the north Finnish rivers as to the Torne and the other northerly Swedish rivers. As regards the south Finnish, Russian, Esthonian and Latvian rivers one can assume that the corresponding age of smolts would be the same as for the mid-Swedish and Mörrum rivers. Professor Järvi kindly informs us that this is the case for the Finnish rivers and Dr. Mannsfeld of Riga states that the age at migration for Latvian smolt is generally two, but also three years.

One is therefore justified in assuming that smolt from Swedish and Finnish rivers entering the Northern Baltic and the Gulf of Bothnia migrate in the main in the third, many however in the fourth and fifth years, from the more southerly

Table 5. Percentage (and number) of ·1 to ·5+maiden salmon.

River	Year	No. of years spent in the sea ·1--1+ % (No.)	·2--2+ % (No.)	·3--3+ % (No.)	·4--4+ % (No.)	·5--5+ % (No.)	No. of specimens investigated
Kalix	1928	10.8 (5)	50.0 (23)	36.9 (17)	2.3 (1)	—	46
—	1929	—	28.3 (15)	54.7 (29)	17.0 (9)	—	53
—	1930	40.0 (20)	10.0 (5)	34.0 (17)	16.0 (8)	—	50
—	1931	6.0 (3)	62.0 (31)	26.0 (13)	6.0 (3)	—	50
	Mean	14.1 (28)	37.2 (74)	38.1 (76)	10.6 (21)	—	199
Lule	1928	—	50.0 (8)	43.7 (7)	6.3 (1)	—	16
—	1929	—	—	77.8 (28)	22.2 (8)	—	36
—	1930	55.6 (45)	21.0 (17)	17.3 (14)	6.2 (5)	—	81
—	1931	35.7 (10)	25.0 (7)	28.6 (8)	10.7 (3)	—	28
	Mean	34.2 (55)	19.9 (32)	35.4 (57)	10.6 (17)	—	161
Ume	1930	0.9 (1)	29.9 (32)	60.8 (65)	8.4 (9)	—	107
—	1931	9.5 (4)	35.7 (15)	42.9 (18)	11.9 (5)	—	42
	Mean	3.4 (5)	31.5 (47)	55.7 (83)	9.4 (14)	—	149
Ångerman	1925	—	33.3 (5)	20.0 (3)	40.0 (6)	6.7 (1)	15
—	1926	2.4 (2)	50.0 (41)	39.1 (32)	7.3 (6)	1.2 (1)	82
—	1927	—	31.3 (26)	66.3 (55)	2.4 (2)	--	83
—	1928	—	16.3 (16)	72.5 (71)	11.2 (11)	—	98
—	1931	5.7 (9)	46.2 (73)	37.3 (59)	10.8 (17)	--	158
	Mean	2.5 (11)	36.9 (161)	50.5 (220)	9.6 (42)	0.5 (2)	436
Indal	1927	—	32.9 (31)	65.0 (61)	2.1 (2)	—	94
—	1928	3.2 (4)	44.4 (55)	49.2 (61)	3.2 (4)	—	124
—	1929	—	10.6 (5)	80.9 (38)	8.5 (4)	—	47
—	1931	—	63.4 (45)	26.7 (19)	8.5 (6)	1.4 (1)	71
—	1932	—	64.4 (9)	35.6 (5)	—	—	14
	Mean	1.1 (4)	41.4 (145)	52.6 (184)	4.6 (16)	0.3 (1)	350
Ljung	1926	—	40.0 (10)	56.0 (14)	4.0 (1)	—	25
—	1927	—	20.7 (6)	75.9 (22)	3.4 (1)	—	29
	Mean	—	29.6 (16)	66.7 (36)	3.7 (2)	—	54
Ljusne	1926	3.7 (3)	34.1 (28)	54.9 (45)	7.3 (6)	—	82
—	1927	1.1 (1)	15.0 (13)	82.8 (72)	1.1 (1)	—	87
—	1929	—	8.5 (7)	72.0 (59)	19.5 (16)	—	82
—	1930	2.3 (1)	7.0 (3)	83.7 (36)	7.0 (3)	—	43
—	1931	4.8 (3)	39.7 (25)	44.4 (28)	11.1 (7)	—	63
—	1932	—	25.0 (7)	67.8 (19)	3.6 (1)	3.6 (1)	28
	Mean	2.1 (8)	21.6 (83)	67.3 (259)	8.8 (34)	0.3 (1)	385
Dal	1928	—	6.3 (6)	75.7 (72)	17.9 (17)	—	95
—	1929	—	15.0 (3)	70.0 (14)	15.0 (3)	—	20
—	1930	—	17.5 (11)	74.6 (47)	7.9 (5)	—	63
—	1931	2.9 (1)	54.2 (19)	34.3 (12)	8.6 (3)	—	35
	Mean	0.5 (1)	18.3 (39)	68.1 (145)	13.1 (28)	—	213
Mörrum	1926	13.5 (13)	29.2 (28)	56.2 (54)	1.0 (1)	—	96
—	1927	4.6 (6)	18.3 (24)	77.1 (101)	—	—	131
—	1928	9.6 (9)	17.0 (16)	73.4 (69)	—	—	94
—	1929	—	9.4 (5)	77.4 (41)	13.2 (7)	—	53
—	1931	6.3 (1)	80.1 (13)	6.3 (1)	6.3 (1)	—	16
—	1932	—	36.9 (24)	63.1 (41)	—	—	65
	Mean	6.4 (29)	24.2 (110)	67.4 (307)	2.0 (9)	—	455

Table 6. Percentage distribution (and number) as to males and females of ·1 to ·5+ salmon

ver	Males								Females							
	·1+		·2+		·3+		·4+		·5+		·1+		·2+		·3+		·4+	
	%	(No.)	%	(No.)	%	(No.)	%	(No.)	%	(No.)	%	(No.)	%	(No.)	%	(No.)	%	(No.)
ıle	23.2	(19)	26.8	(22)	30.5	(25)	19.5	(16)	—		6.5	(7)	41.1	(44)	47.7	(51)	4.7	(5)
ılix	40.9	(27)	15.2	(10)	30.3	(20)	13.6	(9)	—		26.3	(25)	29.5	(28)	41.1	(39)	3.2	(3)
ne	9.3	(5)	29.6	(16)	40.7	(22)	20.4	(11)	—		—		32.6	(31)	64.2	(61)	3.2	(3)
ıgerman .	7.2	(9)	33.6	(42)	44.8	(56)	13.7	(17)	0.8	(1)	0.7	(2)	38.5	(114)	54.4	(161)	6.4	(19)
dal	3.2	(3)	44.2	(42)	42.1	(40)	9.5	(9)	1.1	(1)	0.4	(1)	39.0	(94)	57.7	(139)	2.9	(7)
usne ...	3.6	(3)	15.7	(13)	63.9	(53)	16.9	(14)	—		1.8	(5)	23.0	(63)	68.3	(187)	6.9	(19)
ıf	1.5	(1)	12.1	(8)	59.1	(39)	27.3	(18)	—		—		21.1	(31)	72.1	(106)	6.8	(10)
örrum .	14.9	(29)	35.5	(68)	45.9	(90)	3.6	(7)	—		—		9.1	(18)	89.8	(176)	1.1	(2)
ean	12.5	(96)	28.9	(221)	45.1	(345)	13.2	(101)	0.3	(2)	2.7	(40)	29.1	(423)	63.5	(920)	4.7	(68)

vers, mostly Swedish, entering the southern Gulf Bothnia at two and three years, from the Latvian vers and from Mörrum river mostly at two years ıd from the German and Polish rivers entering e Baltic, one year earlier namely one and two ears. Supported by the above figures the assumption would appear justifiable that these percentages re typical for the different rivers and applicable criterion of salmon races from different rivers.

Earlier works of Rosén, O. Nordqvist ıd myself maintain that different ages of smolts re due to slower growth in the northern than ıe southern rivers, thus causing the usual size of 2—15 cm. reached at migration to be later as one rrives at the more northerly rivers. The growth is robably affected by questions of diet in the more ortherly rivers, flowing through barren mountain anges than in the more southerly rivers flowing ften through districts richer in food, and possibly ırough the shorter period of nourishment in the orthern waters. Investigations in England and reland have also shown that in smaller and enerally poor food-giving rivers the growth is ıferior and in consequence the smolt age higher ıan in the adjacent larger and more nourishing ivers. It is therefore clear that the migration epends to a certain extent on the parr's size. xperiments have shown that by artificial feeding ı ponds, etc. growth can be increased and the eriod of migration hastened forward (Nordvist, Rosén, Olofsson, Alm). On the ther hand Willer endeavoured to prove that rowth was to a certain extent a matter of heredity, ıat parr originating from North Finland being rtificially fed showed inferior growth than fish rom the Rhine bred under similar conditions. In rder to answer the question as to how far migration is connected with growth and size or hether it is due to difference of race further ıvestigations are required.

Sea age at first spawning-migration.

The number of years — "winters" — which ıe salmon lives in the sea before the first spawning migration, known as sea life, are shown in table 5.

Generally one half to two thirds of the fish enter the rivers having lived in the sea under 3 winters counted from the spring migration. A considerable difference however occurs here between the sexes (Table 6). In all rivers males return at either a much lower or much higher sea age than females. The latter have a sea life of either 2 winters, more generally 3 and more seldom 4 winters. The males however return to a large extent as grilse, and to the same extent after 4 winters. In these statistics will be found some males, but no females, with a sea life of 5 winters. The number of two-winter migrants is about the same for both sexes, the mean figure for these being practically similar 2.59 for males and 2.70 for females. The relatively uniform sea life for salmon from different rivers indicates that unfavourable conditions, such as reduced flow of water, abnormal temperature etc., do not influence migrations to any great extent.[1]) After two or three winters the fish seek the rivers whether the conditions of entrance are good or bad. This not being the case one should find considerably greater difference in the age of maiden salmon than is at present the case. A good year-class should therefore show a good yield after a number of years, as also the reverse. Water conditions or other factors, however, which affect the fishery itself may influence the catch in one direction or another.

On account of the relative uniformity of sea life in the Baltic rivers and the increase in migration age with latitude the age of maiden salmon is higher the further north the river is situated, as shown by table 7. The figures for rivers investigated by Rosén are calculated as the mean figures of Rosén's and my own data. The age at entering the Mörrum river is 5 and 4 years, salmon older than 6 are not found with the exception of fish that have already spawned

[1]) Cfr. p. 12.

Table 7. Total age of salmon ascending various rivers, in percentage (and number).

River	3	4	5	6	7	8	No. of specimens investigated
	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	0/0 (No.)	
Kalix	2.0 (4)	11.6 (23)	33.7 (67)	36.7 (73)	15.6 (31)	0.5 (1)	199
Lule	3.5 (12)	18.9 (64)	26.0 (88)	26.6 (90)	21.0 (71)	3.8 (13)	338
Ume	0.3 (1)	6.1 (18)	54.6 (161)	35.6 (105)	3.4 (10)	—	295
Ångerman	1.9 (8)	12.6 (55)	37.6 (164)	42.4 (185)	5.0 (22)	0.5 (2)	436
Indal	0.8 (3)	14.0 (49)	50.3 (176)	31.4 (110)	3.4 (12)	—	350
Ljusne	0.8 (3)	10.6 (41)	48.1 (185)	35.0 (135)	4.9 (19)	0.6 (2)	385
Dal	0.5 (1)	9.4 (20)	54.0 (115)	30.0 (64)	6.0 (13)	—	213
Mörrum	7.2 (33)	24.8 (113)	58.7 (267)	9.3 (42)	—	—	455

(see below). In the more southerly Norrland rivers the spawning migration is mainly at 5 years, but there are also fish of an age of 6 years, a fair number of 7 and even single ones of 8 years of age. In the most northerly rivers the age at first re-entrance is fairly evenly divided between 5 and 6 years and fish of an age of 7 are more frequent than those of 4.

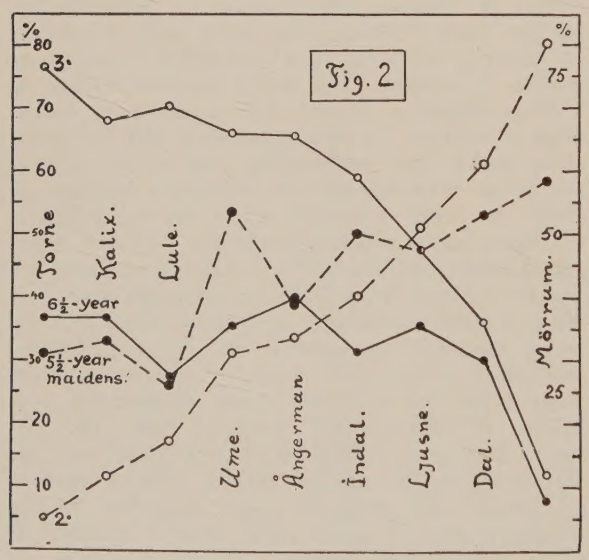

Fig. 2. Smolt age and total age of maidens in various rivers.

This increase in age in the more northern districts is due to the higher smolt age. The age at first spawning does not, as one might think, rise in the same degree as the age at emigration due to the apparent fact that salmon from the more northerly rivers remain a shorter time in the sea between emigration and spawning than they do in southern rivers, (see table 5). The percentage of 3-winter maiden salmon is namely lower in the northern than in the southern rivers whereas inversely the percentage of grilse and of 2-winter maidens is, on the whole, larger than in the south, this specially applies to the most northerly rivers, Torne, Kalix and Lule where there are always caught a relatively large quantity of small salmon of one or barely two winters.

The graph in Fig. 2 describes more closely these conditions. I have elected to give curves for the percentage of 2 and 3-year smolts, partly of maiden salmon 5 and 6 years old. It will be seen that the former curves rise and fall sharply from North to South while the latter ones run more regularly and show a lesser rise or fall. The cause of this is merely that the northern salmon has a shorter sea life than the southern. Thus, in a river where the smolt age is high it would appear that the salmon has a tendency to remain a shorter time in the sea than in a river with a lower smolt age and this difference is, especially in the Swedish rivers, due to geographical environment. This is particularly noticeable in the case of young salmon. It is specially noticeable that the percentage of 3 and 4 year old salmon, with the exception of these in the Mörrum river, do not show much variation in the northern or southern spheres. (Table 7). Among the Mörrum salmon, with a considerably lower smolt age than in the northern rivers, there is a direct effect on the age of re-entrance.

This agrees with conditions in England and Scotland (Calderwood, Menzies) where salmon from smaller rivers have a poorer growth and a higher smolt age than salmon from the larger rivers, and remain a shorter time at sea prior to first spawning migration. In this case it is the size of the river that causes the different period of residence in river and sea, while in the Swedish rivers it is affected by latitude, (in both cases indirectly, the causes being growth and abundance of food).

A similar inverse ratio between residence in river and sea has been found within the same river both in England (Hutton and others) and formerly in the Mörrum river (Alm). The same conditions obtain in the majority of Swedish rivers which I have explored (Table 8). There are several exceptions however, but it is quite obvious that 2-year smolt remain longer in the sea than 4-year smolt.

Table 8. Percentage (and number) of ·1 to ·5+ salmon caught at various smolt ages and in various rivers.

River	River-years	Winters ·1-·1+ % (No.)	·2-·2+ % (No.)	·3-·3+ % (No.)	·4-·4+ % (No.)	·5-·5+ % (No.)
Kalix	2·	19.9 (4)	33.3 (7)	47.7 (10)	—	—
—	3·	11.6 (16)	35.5 (49)	39.8 (55)	13.1 (18)	—
—	4·	20.5 (8)	46.2 (18)	30.8 (12)	2.5 (1)	—
—	5·	—	100.0 (1)	—	—	—
Lule	2·	27.3 (12)	18.2 (8)	47.7 (21)	6.8 (3)	—
—	3·	27.9 (56)	29.4 (59)	30.3 (61)	12.4 (25)	—
—	4·	9.0 (8)	29.2 (26)	49.4 (44)	12.4 (11)	—
—	5·	—	50.0 (2)	50.0 (2)	—	—
Ume	2·	0.8 (1)	10.5 (13)	81.5 (101)	7.3 (9)	—
—	3·	3.1 (5)	36.0 (58)	57.1 (92)	3.7 (6)	—
—	4·	20.0 (2)	40.0 (4)	40.0 (4)	—	—
Ångerman	2·	5.6 (8)	36.3 (52)	40.6 (58)	16.8 (24)	0.7 (1)
—	4·	1.1 (3)	37.2 (106)	55.4 (158)	6.0 (17)	0.3 (1)
—	4·	—	37.5 (3)	50.0 (4)	12.5 (1)	—
Indal	2·	2.1 (3)	35.0 (49)	56.5 (79)	5.7 (8)	0.7 (1)
—	3·	—	46.6 (96)	49.5 (102)	3.9 (8)	—
—	4·	25.0 (1)	—	75.0 (3)	—	—
Ljung	2·	—	35.3 (12)	58.8 (20)	5.9 (2)	—
—	3·	—	20.0 (4)	80.0 (16)	—	—
Ljusne	2·	1.6 (3)	19.9 (39)	70.4 (138)	8.1 (16)	—
—	3·	1.1 (2)	24.0 (44)	65.1 (119)	9.3 (17)	0.5 (1)
—	4·	60.0 (3)	—	33.3 (2)	16.7 (1)	—
Dal	2·	0.7 (1)	14.9 (20)	72.4 (97)	12.0 (16)	—
—	3·	—	23.4 (18)	61.0 (47)	15.6 (12)	—
—	4·	—	50.0 (1)	50.0 (1)	—	—
Mörrum	1·	—	17.6 (6)	82.4 (28)	—	—
—	2·	7.4 (27)	22.7 (83)	67.4 (246)	2.5 (9)	—
—	3·	3.6 (2)	37.5 (21)	58.9 (33)	—	—

These conditions are still clearer if all rivers re set up together as in Table 9 and Fig. 3, and ıay be explained by the fact that sexual maturity hich must be supposed to cause, indirectly, the npulse towards re-entrance, is determined by two ıctors, age and size. A smolt migrated at a higher ge, whether originating from a more northern ver or the same river, reaches sexual maturity uicker when remaining a period of two winters the sea, than a salmon migrated at a lower age ıd therefore younger after 2 winters even though oth fish be of similar size. This however causes certain levelling of age within the river stock and ven among salmon from different rivers.

If we turn again to table 5 and examine the eriod of sea-residence of salmon caught in the vers in different years, we find, that this period aries considerably. Certain years, 2-winter salmon re in the majority and sometimes are to be found rge numbers of grilse. These variations are found multaneously in different rivers. Thus in 1931 a ry high percentage of 2-winter maiden salmon as noticeable and a low percentage of 3-winter

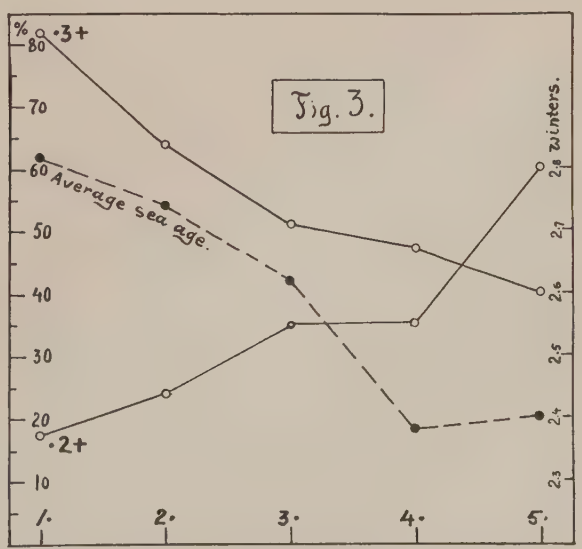

Fig. 3. Correlation between river life and sea life and mean sea age of maidens.

Table 9. Correlation between river life and sea life.

	·1 % (No.)	·2 % (No.)	·3 % (No.)	·4 % (No.)	·5 % (No.)
1·	—	17.6 (6)	82.3 (28)	—	—
2·	4.9 (59)	23.6 (283)	64.2 (770)	7.1 (87)	0.2 (2)
3·	6.3 (84)	34.9 (454)	51.1 (683)	8.5 (113)	0.1 (2)
4·	14.9 (22)	35.2 (52)	47.3 (70)	2.6 (4)	—
5·	—	60.0 (3)	40.0 (2)	—	—
Mean river age:	2.78	2.70	2.52	2.54	2.50

fish. The percentage of salmon of 2 winters was during this year:

Kalix	river.....	62.0 %	as against a		normal of		37.2 %	
Lule	—	25.0	- -	—	-	—	- 19.9	-
Ume	—	35.7	- -	—	-	—	- 31.5	-
Ångerman	—	46.2	- -	—	-	—	- 36.9	-
Indal	—	63.4	- -	—	-	—	- 41.4	-
Ljusne	—	39.7	- -	—	-	—	- 21.6	-
Dal	—	54.2	- -	—	-	—	- 18.3	-
Mörrum	—	80.1	- -	—	-	—	- 24.2	-

At the same time grilse were more plentiful in many rivers. Similar conditions, though not so marked, are found in the year 1926 in the Ångerman, Ljung and Ljusne rivers and in 1930 in the Lule river. In the year 1925, as shown by Olofsson, grilse were the usual. In the same way in 1929 maiden salmon of 4 winters were relatively common in several rivers; thus:

Kalix	river.....	17.0 %	as against a		normal of		10.6 %	
Lule	—	22.2	- -	—	-	—	- 10.6	-
Indal	—	8.5	- -	—	-	—	- 4.6	-
Ljusne	—	19.5	- -	—	-	—	- 8.8	-
Dal	—	15.0	- -	—	-	—	- 13.1	-
Mörrum	—	13.2	- -	—	-	—	- 2.0	-

It is clear therefore that the proportion of salmon of dissimilar sea life varies on the whole on the same line in different rivers, which must be caused by factors of greater range than the actual river conditions. Two factors must here be taken into account, namely the temperature of the sea and the different abundances of the year-classes.

As shown by Johansen and Jacobsen in reports on salmon in the Gudenaa, high water temperature in the spring causes an early sex development and a consequent migration up stream and I have found the same to be the case in the Mörrum river. This is confirmed by a higher percentage of certain year-classes re-entering the river after 1 or 2 winters than is ordinarily the case. Salmon from the northern Baltic who remain during the first winter in the southern Baltic are probably not affected by high water temperature generally until the following year owing to the time elapsed in migration between the two places. The increased number of 2-winter fish migrating up-river in 1926 and 1931 should therefore be due to the high temperature of the water in the Bal during the years 1925 and 1930. Table 33 giv the temperature during different months fr different places shows that the temperature dur the above two years as also in the winter 1930—31 was considerably above normal.

Another factor. namely the presence of different richness of year-classes must also be tak into account. A rich year-class following sudde on a normal or poorer year-class would first sh itself in a plentitude of salmon of 2 or 1 winte As we shall find later, we must reckon with go year-classes yielding good catches during the ye 1926—28 and 1931—33 and therefore the hi percentage of 2-winter fish during the years 19 and 1931 is easily explained.

4. Spawning marks.

The number and percentage of salmon w spawning marks entering the rivers is shown table 10. The fish which survive the first spawni escaping dangers during that or the following ye in the sea and returning to a new spawning seas amount, on an average, to 7.5 %. Of fish wi two spawning marks 8 have been caught, or 0.3 % while no fish with more than 2 spawning mar has even been found. As shown by the table t percentage of fish with spawning marks also vari in different rivers. They are highest in the mi Swedish rivers Ångerman, Indal, Ljung and Ljusn lower in the northern rivers Lule, Ume and D and lowest in the Kalix and Mörrum rivers. P centages vary in different years and chiefly in tho districts with the highest percentage.

Formerly it was supposed that the low pe centage of fish with spawning marks was due the fact that the kelt floated down stream eith dead or in an exhausted condition and were kill by beasts of prey (seals), but Olofsson h recently put forward the theory that intensi fishing in the sea and rivers is the cause of on a small amount of spawning salmon remaining the autumn and thus having the opportunity spawning; the variation in percentage of spawni marked salmon does not seem to support a special theory of this kind; but nothing accoun for the fact that, the percentage being higher in t mid-Swedish rivers, fishing there is less intensiv

ble 10. Percentage (and number) of G-salmon caught in the rivers.

r	Year	Total number investigated	G-individuals No.	%	♂♂[1]	♀♀	2 G
x	1928	46	0	0	—	—	—
.....	1929	56	3	5.4	2	—	—
.....	1930	50	0	0	—	—	—
.....	1931	53	3	5.7	2	1	1
	Total	205	6	2.9	4	1	1
.....	1928	17	1	5.9	—	—	—
.....	1929	44	8	18.2	2	6	1
.....	1930	81	0	0	—	—	—
.....	1931	29	1	3.4	—	1	—
	Total	171	10	5.8	2	7	1
.....	1930	111	4	3.6	—	—	—
.....	1931	44	2	4.5	—	—	—
	Total	155	6	3.8	—	—	—
erman	1925	20	5	25.0	—	—	—
.....	1926	91	9	10.9	4	4	—
.....	1927	87	4	4.6	3	1	—
.....	1928	102	4	3.9	2	—	—
.....	1931	186	22	12.2	7	13	2
	Total	480	44	9.1	16	18	2
al	1927	108	14	12.9	2	7	1
.....	1928	134	10	7.5	2	8	1
.....	1929	53	6	11.3	1	3	—
.....	1931	77	6	7.8	2	4	—
.....	1932	18	4	22.2	—	4	1
	Total	390	40	10.3	7	26	3
ng	1926	34	9	26.5	2	4	—
.....	1927	30	1	3.3	—	1	—
	Total	64	10	15.6	2	5	—
sne	1926	92	10	10.9	8	2	1
.....	1927	96	9	9.4	4	4	—
.....	1929	91	9	9.9	—	6	—
.....	1930	45	2	4.4	—	—	—
.....	1931	70	7	10.0	1	5	—
.....	1932	42	14	33.3	2	12	—
	Total	436	51	11.7	15	29	1
.....	1928	98	3	3.1	1	2	—
.....	1929	25	5	20.0	—	—	—
.....	1930	67	4	6.0	—	—	—
.....	1931	38	3	7.9	—	3	—
	Total	228	15	6.6	1	5	—
rrum	1926	99	3	3.0	1	2	—
.....	1927	133	2	1.5	2	—	—
.....	1928	98	4	4.1	2	2	—
.....	1929	54	1	1.9	1	—	—
.....	1931	17	1	5.9	—	—	—
.....	1932	67	2	3.0	—	—	—
	Total	468	13	2.8	6	4	—
nd Total ...		2597	195	7.5	53	95	8

[1]) Sex not always stated.

Table 11. Percentage (and number) of G-salmon caught in the Sea.

District	Year	Total number investigated	G-individuals No.	%	♂♂	♀♀	2 G
Västerbotten ...	1930	77	1	1.3	—	—	—
— ...	1931	505	25	4.9	—	—	—
— ...	1932	181	11	6.1	—	—	1
	Total	763	37	4.9	—	—	1
Västernorrland .	1930	40	4	10.0	—	—	—
— .	1931	148	2	1.4	—	—	—
— .	1932	14	0	0	—	—	—
	Total	202	6	2.9	—	—	—
Gävleborg	1930	29	4	13.8	—	—	—
—	1931	19	—	0	—	—	—
—	1932	41	3	7.3	—	—	—
	Total	89	7	7.9	—	—	—
Upsala	1931	18	1	5.6	—	—	—
Gotland	1932	154	6	3.9	—	—	—
Kalmar	1933	24	1	4.2	—	—	—
Blekinge	1925	44	1	2.3	—	—	—
—	1926	99	4	4.0	—	—	—
—	1931	126	4	3.2	—	—	—
	Total	269	9	3.3	—	—	—
Kristianstad ...	1932	139	6	4.3	—	—	—
— ...	1933	92	0	0	—	—	—
	Total	231	6	2.6	—	—	—
Malmöhus	1929	119	1	0.9	—	—	—
—	1930	191	—	0	—	—	—
—	1931	233	—	0	—	—	—
—	1932	150	—	0	—	—	—
—	1933	67	—	0	—	—	—
	Total	760	1	0.1	—	—	—
Bornholm	1932	142	10	7.0	—	—	—
Grand Total ...		2652	84	3.2	—	—	1

The percentage varies however in different years and generally in the same direction in different rivers. Thus in 1926 (Ångerman, Ljung and Ljusne) and in 1929 (Kalix, Lule, Indal, Dal) it is relatively high, whilst in 1928 and 1930 it is low in nearly all rivers. The high percentage of second time spawners may be due to a poor immigration of maiden fish in that year or to a stronger immigration of a previous rich year-class or to variations in sex distribution. Table 19 shows that 1926 was a poor salmon year in the above mentioned rivers, as also 1929 for the Indal river; but statistics give no data for confirmation.

Females form the majority of spawning marked salmon, 95 against 53 or 64.2 % and 35.8 % respectively. This in connection with the statement on page 5 (relating to the division as to sex) may possibly explain that the percentage of spawning marked fish is highest in the mid-Swedish rivers. In these rivers the percentage of females

is highest and as those fish that spawn several times are chiefly females, the percentage of spawning marked salmon is highest where the females prevail.

Those spawning marked fish caught in the sea amount to only 3.2 % (Table 11). Of the 2,652 salmon examined only one specimen had spawned twice and no specimen more than twice. This low figure for fish caught at sea seems strange at fi sight but is explained by the fact that the major of these fish consists of smaller specimens whi have been only 1 or 2 winters in the sea. Th amongst 760 salmon from south Scania only specimen had spawned previously.

The above mentioned Swedish figures agr with figures from the Norwegian and Engli rivers.

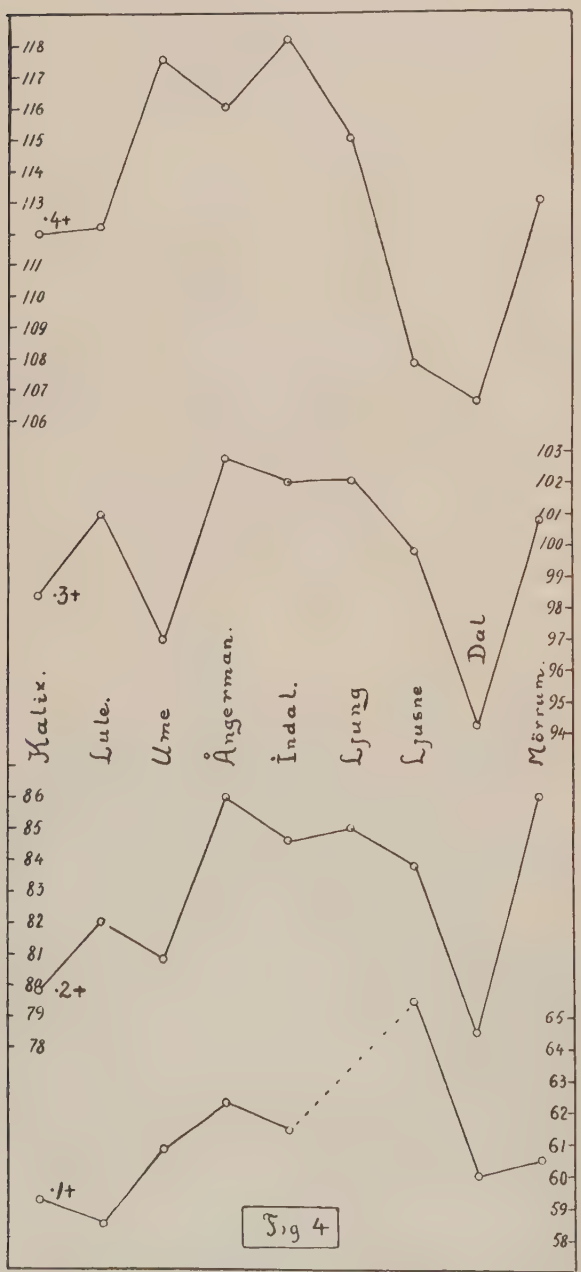

Fig. 4. Mean length (cm.) at various sea ages (·1+ to ·4+) in different rivers.

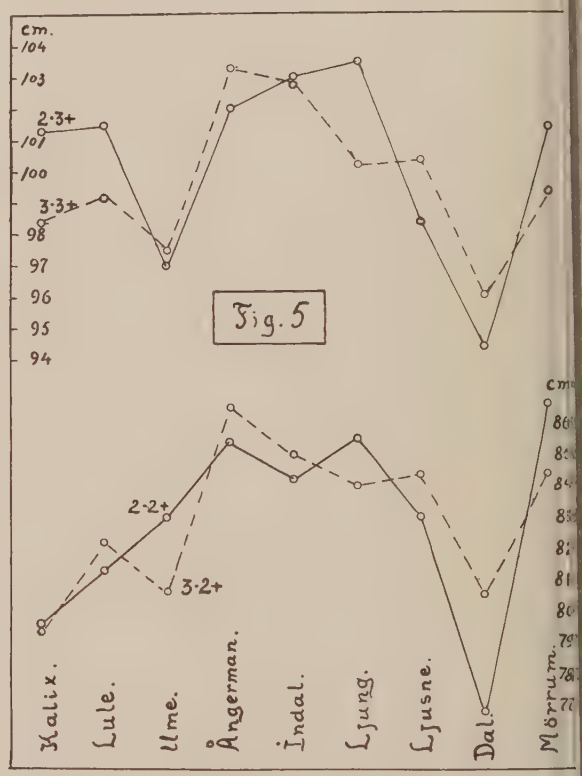

Fig. 5. Mean length (cm.) at various total ages in different rivers.

Spawning marked fish caught in the southe Baltic show a much greater percentage. D i x o has found from 12 to 20 % of larger spawnin marked fish and W i l l e r's figure is 12.5 %. C these 12.5 % or 12 fish (96 examined) 3 ha spawned twice, one three times and one 4 times + a very exceptional case. It is therefore probab that fish surviving first spawning from certai rivers travel to the southeastern parts of the Balti a point to which we shall revert later.

5. Length and weight at first spawning, growth et

The length of fish at first spawning migratio in the Swedish rivers is shown in tables 12 and 2 and in Figs. 4 and 5. Mean length varies con siderably in different rivers, those in the river Da being the smallest. The next in length are foun

Table 12. Mean length in centimetres of salmon caught in rivers at different numbers of winters.

River	·1+	·2+	·3+	·4+
Kalix	59.2 (28)	79.9 (74)	98.4 (76)	112.0 (21)
Lule	58.4 (57)	82.1 (32)	101.1 (57)	111.2 (17)
Ume	60.8 (5)	80.8 (47)	97.0 (83)	117.4 (14)
Ångerman	62.3 (11)	86.0 (156)	102.9 (217)	116.1 (36)
Indal	61.5 (4)	84.7 (145)	102.0 (184)	118.6 (16)
Ljung	—	85.1 (16)	102.1 (36)	115.0 (2)
Ljusne	65.4 (8)	83.7 (84)	99.9 (259)	107.9 (34)
Dal	60.0 (1)	78.4 (38)	94.3 (145)	106.8 (28)
Mörrum	60.5 (29)	86.0 (110)	100.9 (307)	113.1 (9)

the most northerly rivers, whilst the longest fish re found in the Ångerman, Indal and Ljung vers. The difference in size of salmon of similar ge in different rivers amounts to 5 and 6 cm. should be noted here that specimen with a short ea life from northern rivers are just as small, or ven smaller, than those from the Dal river, whilst ie longer the sea-life the greater is the difference etween salmon from those rivers.

Table 13 shows mean length of males and emales divided, in different rivers. Males are istinctly longer than females and this difference ecomes more marked with increased sea life. rowth increment should therefore be different for ie sexes, which seems to be particularly noticeable the larger fish and often amounts to several kg. ariations in average length of salmon, of equal ge, in different rivers, are however regular. Parcularly interesting is the agreement between ariations in 2 and 3-winter maiden fish having ad 2 as well as 3 years of river life. Considering iat this material is relatively extensive and collected through several years the length variations found in salmon from different rivers may be considered permanent and criteria of salmon races of those rivers. The causes may be partly date of spawning migration or partly hereditarily determined growth.

There are few statistics relating to time of migration. I have in table 14 made a summary of O. N o r d q v i s t's figures. From these we see that the Mörrum river salmon enter chiefly in May and June, in Dalarna in June, in Ume and Torne in July. The period is therefore later in the more northerly rivers due to ice drift and high water conditions. One would suppose that the later migrating salmon would be larger than those entering the river at an earlier date.

The length however seems to vary between the northern and southern rivers and it is possible that this difference is due to race peculiarities. As already shown (R o s é n and A l m) it is the, in sea life, youngest salmon which shows a considerable growth during the year in which it returns,

Table 13. Mean length in centimetres of males and females caught in the rivers.

River	2·2+ ♂	2·2+ ♀	3·2+ ♂	3·2+ ♀	2·3+ ♂	2·3+ ♀
Ume	—	—	84.5 (12)	79.1 (31)	99.9 (7)	96.3 (22)
Ångerman .	86.5 (12)	85.1 (39)	84.9 (29)	85.9 (73)	108.4 (11)	100.5 (47)
Indal	84.4 (19)	85.1 (24)	87.5 (23)	84.2 (67)	112.1 (17)	100.6 (60)
Ljung	86.5 (6)	85.0 (6)	—	—	108.7 (3)	102.7 (17)
Ljusne	82.7 (7)	83.4 (23)	88.4 (5)	84.1 (36)	104.0 (31)	96.5 (100)
Dal	82.2 (5)	74.5 (14)	80.0 (2)	80.6 (16)	97.9 (27)	93.2 (70)
Mörrum ...	85.9 (47)	86.1 (15)	83.1 (13)	86.7 (3)	102.7 (60)	97.2 (130)

River	3·3+ ♂	3·3+ ♀	2·4+ ♂	2·4+ ♀	3·4+ ♂	3·4+ ♀
Ume	103.3 (14)	95.2 (32)	118.4 (6)	111.3 (3)	119.8 (5)	—
Ångerman .	106.5 (45)	101.9 (111)	122.9 (16)	107.0 (7)	120.0 (6)	109.9 (6)
Indal	113.0 (23)	100.2 (77)	117.5 (4)	118.2 (4)	123.4 (5)	112.7 (3)
Ljusne	103.9 (21)	98.9 (87)	113.7 (6)	106.8 (4)	109.8 (5)	101.8 (12)
Ljung	110.0 (1)	99.6 (15)	115.0 (2)	—	—	—
Dal	102.0 (12)	94.1 (35)	113.0 (10)	96.5 (6)	110.1 (8)	101.3 (4)
Mörrum ...	—	—	114.4 (7)	102.0 (1)	—	—

although growth increment decreases with increasing age. The 3-winter salmon will hardly show any growth during the last year.

This theory, however, does not quite agree with observations, but deviations from the rule may be due to hereditary racial peculiarities in certain rivers. Obviously the growth is slower in the northern rivers and increasing with the number of winters, a fact which may explain the above mentioned length proportions between salmon from these rivers and those from the Dal river.

The fish's form, i. e. length in relation to weight, varies according to river. In table 31 I have collated these ratios which for certain rivers are also given in Graph 6. The weight in relation to length is visibly lower in the Mörrum, Ljusne and Ångerman rivers and in a lesser degree in the Indal than in the Kalix and Lule. Salmon in the former rivers are generally in the higher number of winters longer and thinner than salmon in the latter ones.

In spite of these differences it is clear that the salmon's growth is, on the whole, quite regular, and this is shown in tables 15 and 16 and in table 30, in which I have compiled mean lengths of

Fig. 6. The ratio length (cm)/weight (kg.) for various rivers.

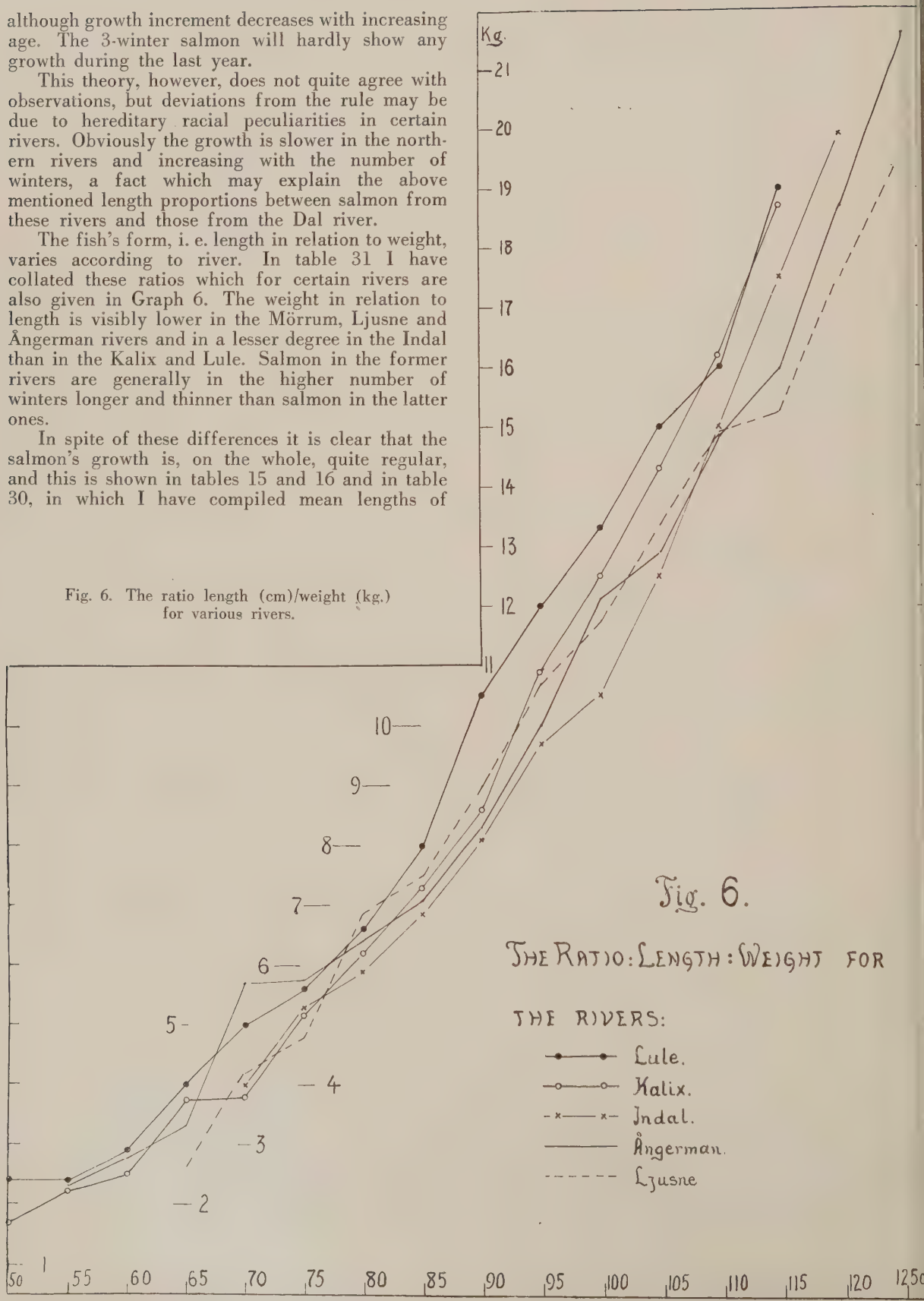

Table 14. Percentage distribution as to month of the spawning migration for certain rivers (according to O. Nordqvist).

River	March	April	Maj	June	July	Aug.	Sept.	Oct.	Total No. of salmon caught
Torne	—	—	—	24.7	74.0	1.3	—	—	23,207
Kemi	—	—	—	41.5	55.3	3.2	—	—	6,080
Ume	—	—	—	40.9	55.0	3.9	0.2	—	4,336
Dal	—	—	23.3	63.5	12.0	1.2	—	—	13,524
Mörrum	—	1.6	33.0	36.0	23.0	5.0	2.4	—	
— [1]	0.7	5.7	35.2	34.6	16.1	4.7	1.4	1.6	12,363

[1] The years 1919—1923 according to Alm.

Table 15. Mean length in centimetres of salmon caught in the sea at various numbers of winters (and number investigated).

	·+ (Autumn)	·1 (Spring)	·1+ (Summer)	·1+ (Autumn)	·2 (Spring)	·2+ (Summer)
Obbola	—	—	—	—	—	81.1 (53)
Täfteå	—	53.0 (172)	—	—	—	82.4 (132)
Holmön	—	—	—	—	—	85.2 (94)
Ulvöarna	—	—	68.5 (32)	—	—	—
Bremön	38.9 (37)	—	—	—	77.5 (13)	—
Alnön	—	51.4 (63)	—	—	—	85.5 (13)
Gnarp	—	43.7 (25)	—	—	76.4 (39)	—
Grisslehamn	—	50.0 (14)	—	—	—	—
Gotland	—	—	—	74.4 (38)	80.8 (48)	—
Öland	—	—	—	—	—	—
Pukaviken	—	—	—	—	75.0 (16)	—
Karlshamn	—	—	—	79.2 (76)	79.8 (81)	—
Hanöbukten	—	—	—	—	77.9 (31)	—
Simrishamn	—	48.9 (15)	—	—	82.4 (135)	—
Malmöhus län	—	46.6 (352)	—	—	79.2 (376)	—
Bornholm	—	—	—	—	89.5 (42)	—

	·2+ (Autumn)	·3 (Spring)	·3+ (Summer)	·3+ (Autumn)	·4 (Spring)	·4+ (Summer)
Obbola	—	—	96.8 (42)	—	—	111.2 (5)
Täfteå	—	—	102.1 (76)	—	—	117.2 (12)
Holmön	—	—	102.1 (113)	—	—	113.3 (4)
Ulvöarna	—	—	—	—	—	—
Bremön	—	—	—	—	—	—
Alnön	—	—	100.8 (17)	—	—	118.4 (8)
Gnarp	—	101.8 (10)	—	—	—	—
Grisslehamn	—	—	—	—	—	—
Gotland	100.5 (45)	100.9 (7)	—	102.4 (12)	—	—
Öland	—	107.9 (11)	—	—	—	—
Pukaviken	—	96.5 (31)	—	—	116.0 (3)	—
Karlshamn	98.2 (28)	101.8 (17)	—	117.3 (3)	121.0 (1)	—
Hanöbukten	—	—	—	—	—	—
Simrishamn	—	109.1 (39)	—	—	—	—
Halmöhus län	—	104.5 (24)	—	—	120.0 (1)	—
Bornholm	—	105.9 (89)	—	—	—	—

lmon caught in the sea. Table 15 shows how gularly mean length increases with sea life and w well they agree with corresponding figures for er-caught salmon. Tables 15 and 16 give the ean length in the same district but at different nes of the summer fishing season and a comparison shows that the growth during the second and third winter in each year is 13 cm. from mid-May to mid-August, maximum growth by the end of this season, but from mid-August to mid-May of the following year over 20 cm. It is also found that fish caught off Scania, Gothland and other

Table 16. Mean length (cm.) of salmon caught in the Västerbotten (Täfte) at various periods of the summer of 1931.

Age	16-31 May	1-15 June	16-30 June	1-15 July	16-31 July	1-15 Aug.
2·1—2·1+	47.4 (10)	49.1 (13)	49.0 (24)	52.6 (11)	60.6 (11)	60.8 (4)
3·1—3·1+	46.5 (2)	48.0 (7)	52.3 (23)	54.7 (13)	60.7 (10)	58.7 (6)
Mean	47.2 (12)	48.8 (20)	50.7 (47)	53.8 (24)	60.6 (21)	59.5 (10)
2·2—2·2+	—	78.5 (2)	84.0 (13)	86.3 (8)	—	—
3·2—3·2+	84.0 (1)	81.9 (10)	83.7 (26)	84.4 (12)	89.3 (4)	94.0 (1)
Mean	84.0 (1)	81.3 (12)	83.8 (39)	85.2 (20)	89.3 (4)	94.0 (1)
3·3—3·3+	—	101.6 (10)	101.5 (13)	105.1 (9)	—	—

places in the southern Baltic scarcely vary in size between late autumn and spring. I have further supplied figures of the salmon's mean weight in 1932, in February in the Bay of Hanö and in May off Bornholm. In the former case the weight varied between 3—5 kg. (2-winters) and 8—10 kg. (3-winters), in the latter case 4—7 kg. and 9—12 kg. respectively. This equals a growth of over 1 kg. per 3 months. During the same spring I obtained a number of figures relating to the size of catches off Scania and Bornholm, intensive fishery being undertaken from Simrishamn. The fish were divided into large salmon of about 10 kg. and middle salmon of about 5 kg. From April 20th to May 12th there were caught 333 large salmon or 3,989 kg. (average weight 11.9 kg.) and 254 salmon of middle size or 1,463 kg. (average weight 5.8 kg.). The corresponding figures for the period May 19th to June 2nd were: large 106 or 1,347 kg. (mean 12.7) and middle 51 or 321 kg. (mean 6.3). Thus in less than a month the weight had increased by 0.8 for large and 0.5 kg. for middle-sized fish.

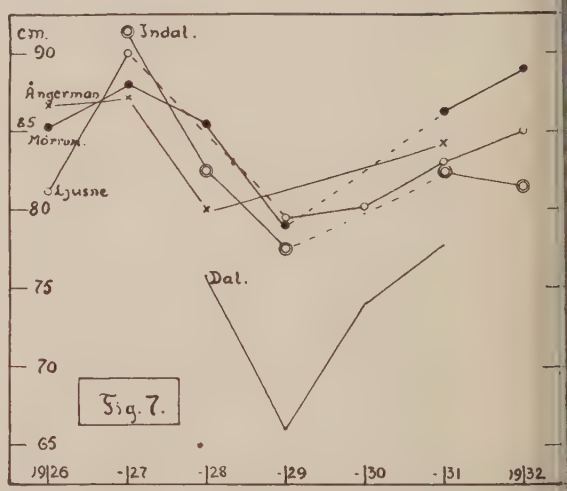

Fig. 7. Variation of mean length (cm.) of 2·2+ maide of various rivers, (1926—32).

Table 17.

Mean weight of all salmon caught in various rivers from 1914—1931.

	River								
	Lule	Skellefte	Ume	Ångerman	Indal	Ljung	Ljusne	Dal	Mörrum
1914	9.5	10.2	6.5	10.0	9.0	—	—	6.0	9.0
15	—	8.8	—	—	—	—	—	6.0	8.8
16	—	9.8	9.2	10.0	9.2	—	—	6.8	8.0
17	—	11.0	11.5	11.2	10.0	10.2	—	7.0	8.8
18	—	10.2	—	11.5	10.2	10.0	—	6.0	9.0
19	—	8.5	7.7	9.7	8.7	8.0	—	6.0	7.0
1920	10.3	10.5	7.7	11.0	9.2	9.4	—	5.0	8.0
21	10.0	9.5	9.5	10.3	9.5	—	—	7.0	7.5
22	10.8	10.0	9.5	11.7	9.7	9.5	—	6.7	8.0
23	10.7	9.3	9.3	10.5	9.5	9.3	—	6.5	8.3
24	—	9.6	8.7	11.0	10.0	9.9	—	6.2	8.0
25	—	11.2	8.4	9.4	8.8	10.0	—	7.0	8.0
26	—	—	—	9.3	8.6	10.4	—	—	—
27	—	—	—	10.2	9.1	9.3	9.5	6.2	—
28	—	9.9	—	10.7	9.6	9.1	9.7	6.6	—
29	—	10.0	—	11.1	9.3	9.2	10.0	6.8	—
1930	—	8.3	9.0	10.7	10.2	—	10.0	6.5	—
31	—	10.7	8.9	10.2	8.6	9.2	9.4	4.6	9.1
Mean	10.1	9.8	8.8	10.5	9.4	9.5	9.7	6.3	8.3

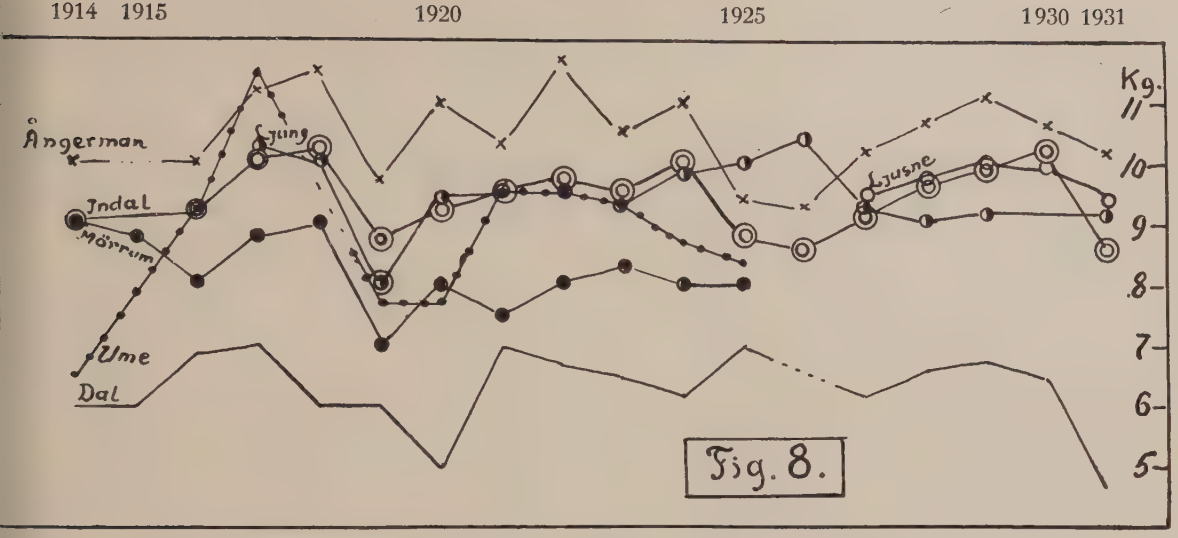

Fig. 8. Variation of mean weight (kg.) of salmon from various rivers, (1914—1931).

Growth is therefore greatest in the spring and summer months and if we turn to tables 29 31 and take the average lengths and weights the different rivers we see that the increase is, he whole, uniform. The length in the different groups is thus highest in 1927, and in many s rises in 1931 and 1932, whilst it is consider- lower in 1929 and 1930. As regards weight shows the highest figures. The most striking larity is to be found in different years in ion with two river years (Fig. 7). Probably the on is due both to the difference in migration and to the annual growth in the sea.

Finally I will discuss the question of the age weight of fish caught in a certain river. ble 17 and Fig. 8). This depends partly on age-group — in respect of sea life — and ly on the size of the fish within these groups. regards sea life I have already pointed out that he most northerly rivers the maiden fish of 1 2 winters are relatively more common than in the more southerly rivers. This must lower the mean weight in the northern rivers, but as the weight in relation to length is higher in these than in the south the effect of the sea life can to a certain extent be discounted. In the Dal river where the length increment is particularly poor the mean weight is generally lower than further north, next comes the Mörrum river, probably due to the low relative weight. In the Indal, Ångerman and other rivers with good growth the mean weight should be the highest and this is also confirmed. Another cause of this is also the high sea age in respect of salmon from these rivers.

Fig. 8 shows that in certain years the variations in mean weight agree very well, but during other years the conformity is poor or non-existent even. The good conformity of figures found for the years 1916—1922 between the Ångerman, Indal and Mörrum rivers and in the years 1923—1930 also between the two first named rivers indicates similar causes. One must reckon partly on changes

Table 18.
Total weight (and percentage) by different ages of 100 salmon of one year-class ascending various rivers.

Total age in years	3	4	5	6	7	8
Kalix	4.2 (0.6)	36.2 (4.9)	195.7 (26.4)	307.6 (41.3)	190.5 (25.7)	8.0 (1.1)
Lule	8.1 (0.9)	42.0 (4.6)	221.1 (24.1)	341.5 (37.2)	283.5 (31.0)	20.4 (2.2)
Ume	6.9 (0.7)	65.5 (7.1)	470.2 (50.9)	364.7 (39.5)	16.5 (1.8)	—
Ångerman	6.7 (0.7)	103.6 (10.9)	323.5 (34.0)	447.4 (47.3)	64.1 (6.7)	3.7 (0.4)
Indal	2.1 (0.2)	93.8 (10.3)	423.6 (46.6)	334.4 (36.7)	56.0 (6.2)	—
Ljusne	2.7 (0.3)	68.6 (7.4)	434.2 (46.9)	361.8 (39.1)	55.2 (5.9)	4.0 (0.4)
Ljung	—	155.0 (16.9)	427.0 (46.7)	332.0 (36.4)	—	—
Dal	1.0 (0.1)	47.0 (5.7)	429.2 (52.3)	277.7 (33.7)	67.7 (8.2)	—
Mörrum	23.9 (2.7)	188.4 (21.6)	572.4 (65.8)	86.6 (9.9)	—	—

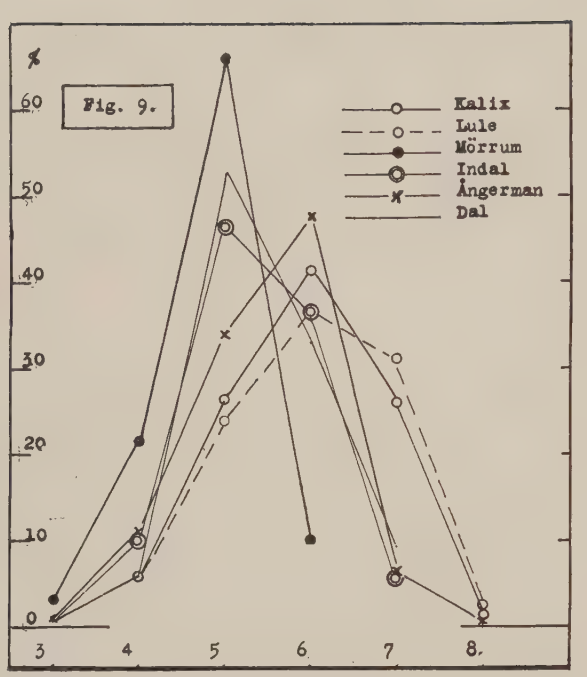

Fig. 9. Percentage distribution as to weight (kg.) by different ages of a certain year-class in various rivers (cf. tab. 18).

in the season of migration, with equal effect to all rivers, partly on different feeding conditions (as to years) in the sea. Finally and not least account must be taken of the different abundance of the year-classes. A good year-class must first be traced by a plentitude of fish of low sea age resulting in a low mean-weight in a certain y and a high one the next; this would account the low mean weight of the years 1919, 1925— and 1931, though in the year 1931 the size of f at a certain sea age was above the normal. (Fi 7 and 8). Thus a low mean-weight is often a s of good fishing prospects for the coming year, a may occur at the same time as a high yield, if year-class in question is particularly rich.

On the basis of the age of smolt, the age grilse and maidens, mean weights and lengths different sea ages it is possible to establish percentage weight for a year-class in differ years. In table 7 the age at ascending in differ streams has been fixed. For each age-group percentage number of maiden salmon with 1 and more winters has been calculated. The numb have been multiplied by the average weight a the results have been totalled for each age-grou Thus has been obtained the weight in differ years of 100 maiden salmon of a given year-cl and a summary of such percentages is shown table 18 and Fig. 9.

From this we arrive at the fact that the great weight of a certain year-class in the southern riv is at a total age of 5 years and in the northe at 6. On this basis it is easy to calculate when plentiful breed is likely to show itself. As I ha shown in earlier works the artificial hatching salmon in the Swedish rivers has up to now be much too small to have any noticeable effect the size of the catch. Recent hatchings in the D river should however be of such importance th it may effect the size of the catch in this riv during the next years, and this seems already be the case.

II. Fishing returns.

Salmon fishery is carried out in the Swedish, Finnish, Esthonian and Latvian rivers and to a certain extent in the German and Russian rivers as well as parts of the Baltic. River fishery takes place mainly in the summer, sea fishery in the northern Baltic in the spring and summer, in Finland however up to the winter, and in the southern waters in the autumn, winter and spring. As regards the following it should be stated that Sea Trout is included in the returns except for Sweden and Denmark.

1. The Swedish rivers.

Details of salmon fishing in the northern rivers that yield at least 1000 kg. as well as those of Dal and Mörrum will be found in table 19 and partly in Fig. 10. For certain reasons it has not be possible in recent years to obtain figures relati to the most northerly rivers. The annual mea catch over the 10-year period 1915—1924, whi includes all rivers, with the exception of, inte mittently, the Skellefte river, was 161,530 kg. wi a maximum (in 1921) of 228,890 kg. and minimum of 111,950 kg. (in 1915). The mea catches of the rivers for 20 years totalled 147,9 kg. In the table will also be found mean catch for the whole period for each river and a percenta return for each individual river. In the first ra will be found the Torne and Lule rivers with 18 and 21 % respectively, followed by the Kalix wi 9.8 %. It should be observed that in these thr rivers the years 1929—1931 which were very b

e 19. Quantity in kilogrammes of salmon caught in the Swedish rivers of the Baltic (1913—1932).

ear	Torne	Kalix	Lule	Skellefte	Ume	Ångerman	Indal	Ljung	Ljusne	Dal	Mörrum	Total	Year
.....	—	25,000	32,630	—	6,500	14,880	7,650	2,230	—	—	24,580	113,470	1913
.....	—	11,240	21,910	—	7,650	10,850	8,660	2,340	21,570	32,000	21,770	137,990	
.....	15,530	4,880	15,340	—	7,700	11,800	11,540	870	21,570	8,420	14,300	111,950	1915
.....	25,610	8,380	19,410	—	8,700	15,540	13,640	1,110	14,980	8,880	21,570	137,820	
.....	43,580	14,280	20,700	—	8,500	15,890	15,920	1,920	15,320	5,510	21,270	162,890	
.....	31,670	6,700	14,000	—	10,200	15,010	10,860	1,340	9,530	4,950	13,060	117,320	
.....	31,000	25,190	35,360	6,690	11,800	12,930	8,780	770	8,000	1,820	10,990	153,330	1919
.....	31,990	19,380	57,240	6,270	10,000	21,570	8,570	880	10,390	2,220	23,810	192,320	Mean:
.....	55,330	17,670	57,790	5,100	12,690	23,300	16,850	3,270	14,030	4,290	18,570	228,890	161,530
.....	41,380	15,870	38,490	6,100	16,350	18,620	16,000	1,760	14,800	6,510	20,750	196,630	
.....	23,570	12,560	39,340	4,740	16,660	17,370	23,160	3,690	21,150	7,360	22,910	192,510	
.....	16,490	11,990	20,980	2,970	13,200	12,330	15,740	1,460	13,990	3,610	8,900	121,660	
.....	6,280	—	—	5,750	9,340	14,010	15,840	1,980	12,190	—	5,440	70,830	1925
.....	6,750	—	—	2,090	10,070	6,760	15,590	1,650	11,080	—	5,390	53,990	
.....	—	—	—	3,210	20,690	13,110	11,680	1,950	14,210	7,660	9,500	70,290	
.....	—	—	—	2,440	15,610	8,640	8,830	1,660	11,440	3,100	—	50,990	
.....	—	—	—	—	10,440	5,030	4,810	930	12,150	3,120	4,860	35,650	
.....	—	—	—	—	9,550	7,880	6,840	1,000	11,150	2,740	4,560	33,260	1930
.....	—	—	—	2,950	2,620	6,470	7,680	830	7,810	3,150	4,860	36,370	
.....	—	—	—	3,830	1,310	8,140	11,810	2,110	7,870	4,100	—	—	
.....	27,430	14,430	31,100	4,350	10,480	13,010	12,020	1,710	13,330	6,440	13,670	147,970[1])	
.....	18.5	9.8	21.0	2.9	7.1	8.8	8.1	1.2	9.0	4.4	9.2		
nate) of the (km.) essible ion ...	480	360	260	40	200	170	120	100	160	80	60		

and mean of the various rivers.

le 20. The Swedish salmon fishery in kilogrammes in various districts of the Baltic (1914—1932).

Year	Norr-botten	Väster-botten	Väster-norrland	Gävle-borg	Upsala	Stock-holm	District Got-land	Kalmar[1])	Blekinge	Kristian-stad	Malmö-hus	Total	Year
.....	60,520	16,310	9,150	5,290	1,540	1,300	3,340	20,110	15,150	6,030	3,440	142,180	1914
.....	56,650	18,630	16,170	7,650	2,080	1,210	1,730	24,510	13,330	8,910	6,570	157,440	1915
.....	37,480	16,260	21,720	4,110	2,560	1,660	2,710	12,850	5,820	3,900	2,140	111,210	
.....	74,890	30,360	12,400	5,560	1,000	2,040	1,290	25,620	10,930	2,430	1,750	168,270	
.....	43,390	15,580	12,720	4,850	490	1,200	1,590	23,340	4,680	2,150	920	111,910	
.....	76,930	20,950	14,670	3,680	670	1,210	26,820	14,420	39,760	9,670	4,850	213,630	
.....	115,320	20,900	15,460	8,430	460	1,770	34,790	17,170	73,610	16,040	7,670	311,620	1920
.....	176,230	43,640	11,031	9,260	1,470	1,630	27,370	18,480	77,860	16,190	3,040	386,200	
.....	137,170	24,320	10,080	11,050	900	1,610	15,250	12,070	46,600	5,400	2,560	267,010	
.....	101,400	34,130	16,920	13,100	1,320	2,490	5,890	30,660	40,030	7,660	3,990	257,590	
.....	69,630	20,870	7,980	4,650	970	2,500	3,490	26,480	39,230	3,680	1,230	180,640	
.....	37,040	15,930	8,430	4,040	960	2,300	3,900	30,600	21,670	—	1,130	126,000	1925
.....	33,810	19,770	8,840	5,230	860	2,230	4,320	34,980	45,830	6,240	7,470	169,580	
.....	69,250	35,920	12,730	5,430	1,210	2,620	25,550	73,040	41,520	5,940	2,520	275,730	
.....	68,880	28,800	13,920	6,720	730	2,440	11,870	58,170	62,470	7,130	6,670	267,800	
.....	48,130	16,350	6,240	3,550	650	2,130	16,660	42,960	24,470	4,560	6,120	171,820	
.....	64,450	22,130	8,150	4,100	530	2,180	10,330	32,350	36,550	6,430	3,200	190,400	1930
.....	79,030	20,780	10,800	4,410	570	1,600	7,410	33,130	178,820	12,140	14,600	363,290	
.....	77,030	21,670	10,000	8,110	700	2,150	7,930	60,150	133,470	21,220	5,060	347,490	
.....	75,117	23,332	11,969	6,275	1,035	1,909	11,170	31,110	47,985	8,090	4,470	222,462	
.....	33.8	10.5	5.4	2.8	0.5	0.9	5.0	14.0	21.6	3.6	2.0		

ea trout included.

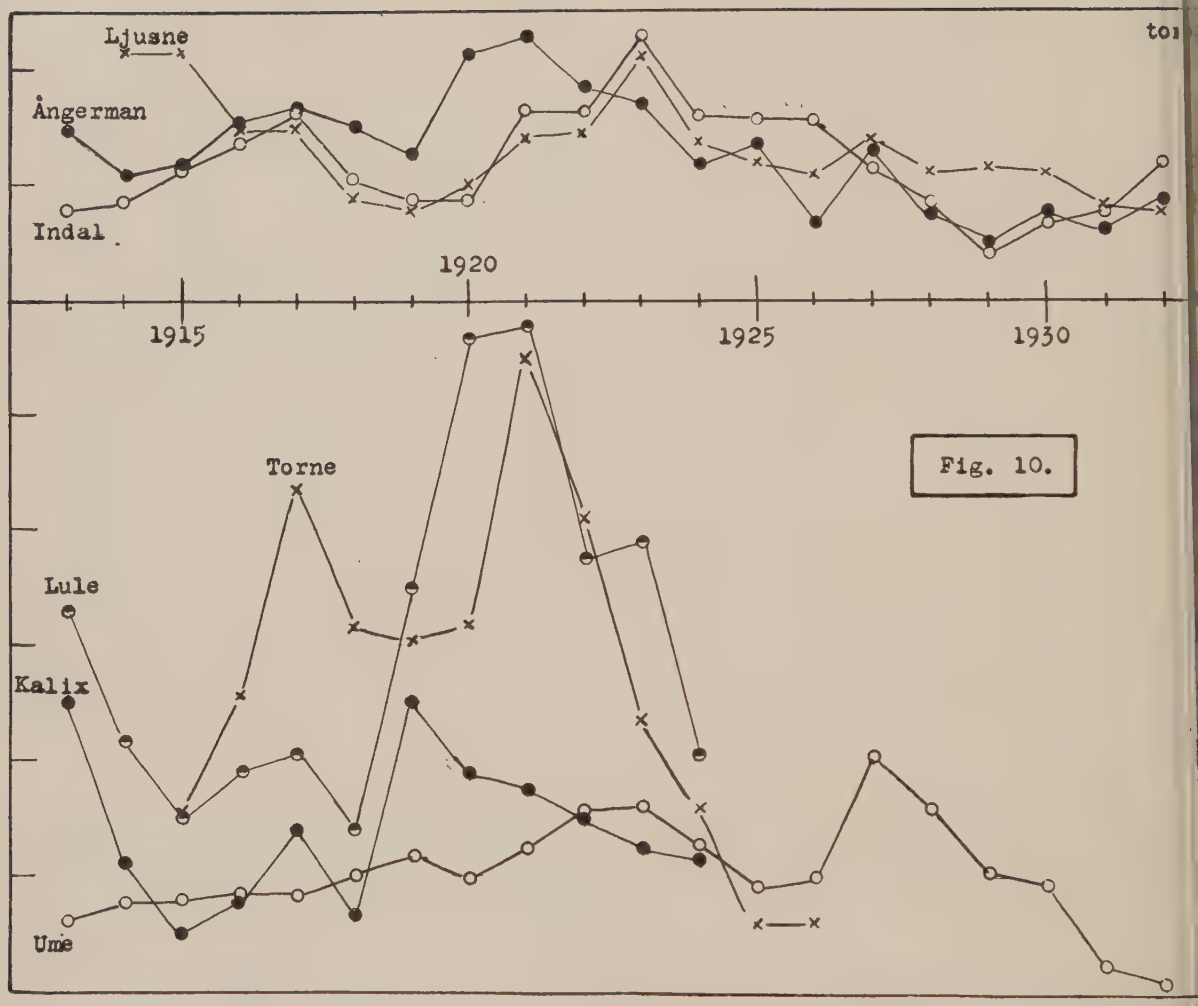

Fig. 10. Quantities (metric tons) of salmon caught in various Swedish rivers.

ones in other rivers are not included, which would give them a lower figure. It appears also that the varying returns are much the same in all the northern rivers. All rivers showed good catches for the period 1920—23 and bad catches for the years 1915, 1918 and 1926.

In former years the catches in the Dal and Ljung rivers show much higher figures, as explained in table 19. Through the erection of power stations, pollution etc. natural conditions have changed and above all a smaller portion of the rivers is now accessible to salmon — thus the amount of fish has decreased. Similar observations have been made in respect of the rivers Mörrum and Ume.

These facts connected with quantities caught in different rivers in relation to stretches of the riv available to salmon indicate, quite naturally, t quantities, to some extent, depend on the length waterway available (see Table 19). It is obvi that a long river, normally with a greater num of spawning banks and nursery grounds, prese better conditions for a rich stock than the grounds in a river less accessible.

Other factors contribute, such as the riv shorter or longer watershed which increases diminishes the number of breeding places and t raises or lowers the supply of fish. The cl relation between the returns and the accessibi of rivers offers certain possibilities of improvem to which subject I will return later.

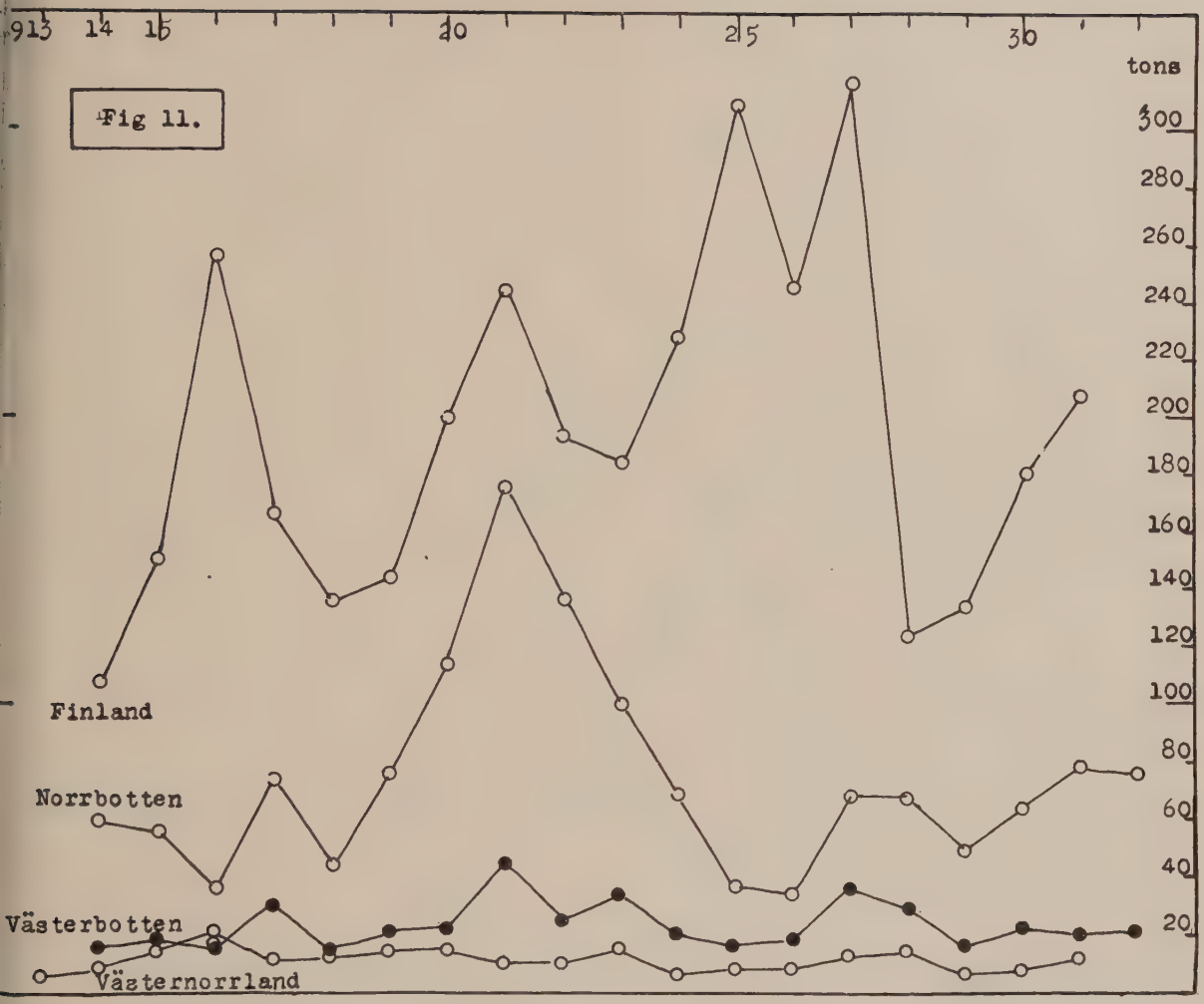

Fig. 11. Quantities (metric tons) of North Swedish and Finnish catches in the sea.

Swedish fisheries in the Baltic.

Table 20 shows the returns for the various wedish Baltic districts. The mean annual catch nounts to 222,462 kg. with a maximum year in 921 (386,200 kg.) and minimum in 1916 (111,210 g.) The discrepancy is therefore much larger an in the rivers. As regards districts: Norrbotten mes first with 75,000 kg., Blekinge with 48,000 g. (this figure being high owing to the very usually heavy years 1931 and 1932), next comes almar whose figures include sea trout. The lowest eld is from the provinces of Uppsala and Stockolm which give 1,000 and 2,000 kg. respectively.

Examining the annual variation within each rovince (Fig. 11 and 12) we find for the 3 northern provinces that these variations are on the whole uniform though more marked in Norrbotten. The year 1921 shows the best catches, and the years 1917, 1920—1923, 1927—1928 and 1930—1932 are noted for good catches. Bad catches were met in the years 1918, 1925—1926 and 1929.

Proceeding further south to the provinces of Gothland and Kalmar we note that here too the catches vary considerably and to a certain extent simultaneously, the best years for Gothland being for the period 1919—1922 and 1927, and thus fall within or come shortly before the good years in the northern provinces. Similar conditions prevail for Kalmar which was best in the year 1927. Corresponding conditions are shown for Blekinge,

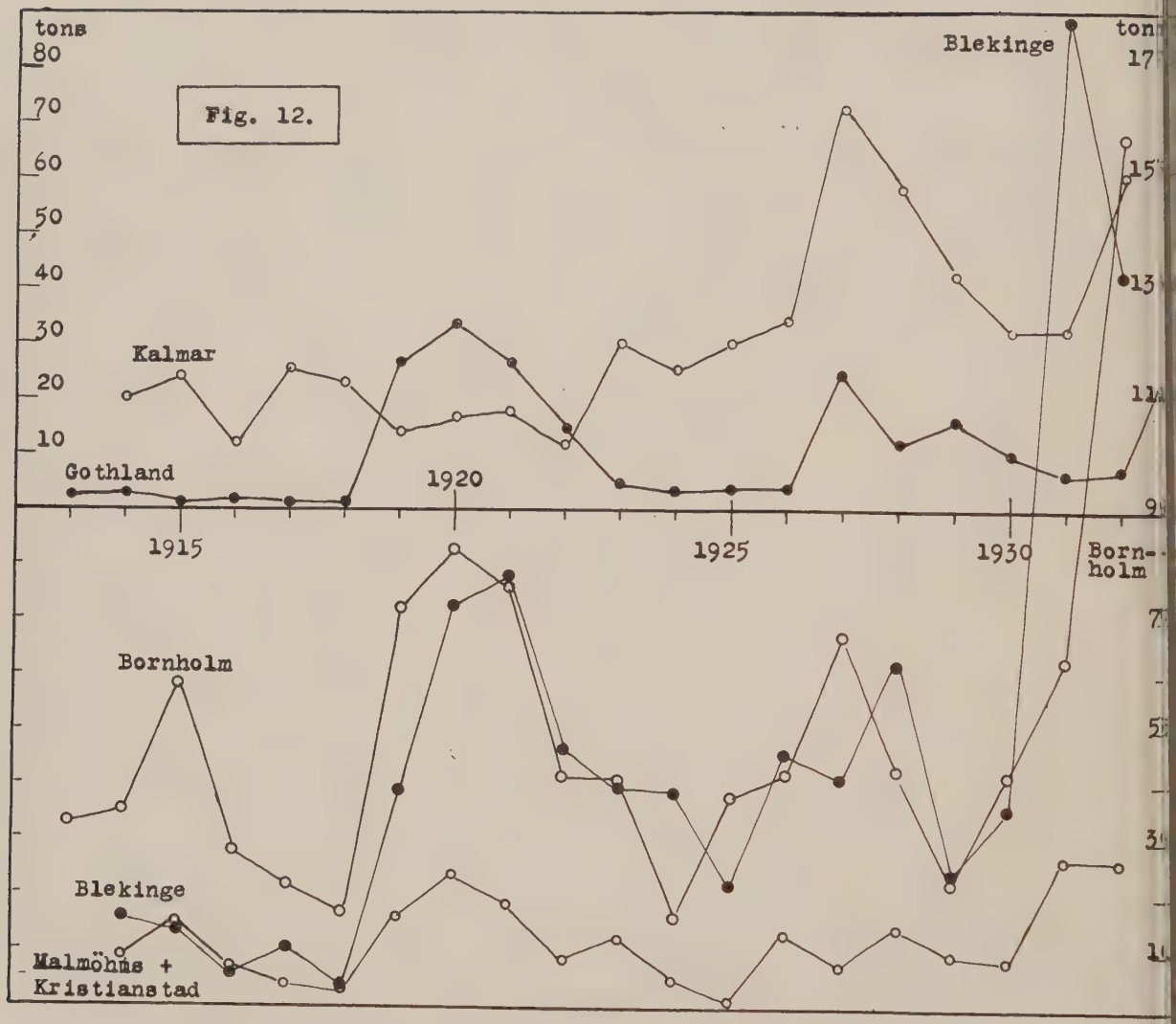

Fig. 12. Quantities (metric tons) of catches in mid-Baltic and south-western Baltic.

this being quite natural as fishermen from Blekinge, Kalmar and partly from Gothland fish far out to sea often in the same districts. The greatest discrepancy is found in the years 1931 and 1932, the former showing, in Blekinge, about double the amount of any previous year whilst in Kalmar the catch was only of medium size. The year 1932 is for Kalmar a very good one but the return has fallen somewhat in Blekinge, where it has however kept up its average.

For the province of Kristianstad and Malmöhus where fishing is of a purely coastal character great similarity is found with the province of Blekinge with best years in 1915, 1919—1921, 1926, 1928 and 1931—1932.

3. Salmon fisheries in other Baltic Countries.

The return of sea fishery in the different Balti countries is found in table 21 where for the sak of completeness the Swedish returns are included From Esthonia I have, thanks to the obligin assistance from Chief Fishery Inspector K o d r e s received similar statistics. Excepting Sweden and Denmark sea trout are included in the statistics. I we proceed north we find that Finland, like Sweden shows marked variation during different years Whilst in certain years, such as 1917—1923 and 1929—1931, there is complete correlation betwee the northern Swedish fisheries, in Finland good fishing years are found in the years 1916, 1925 and 1927 whilst in the northern Swedish provinces

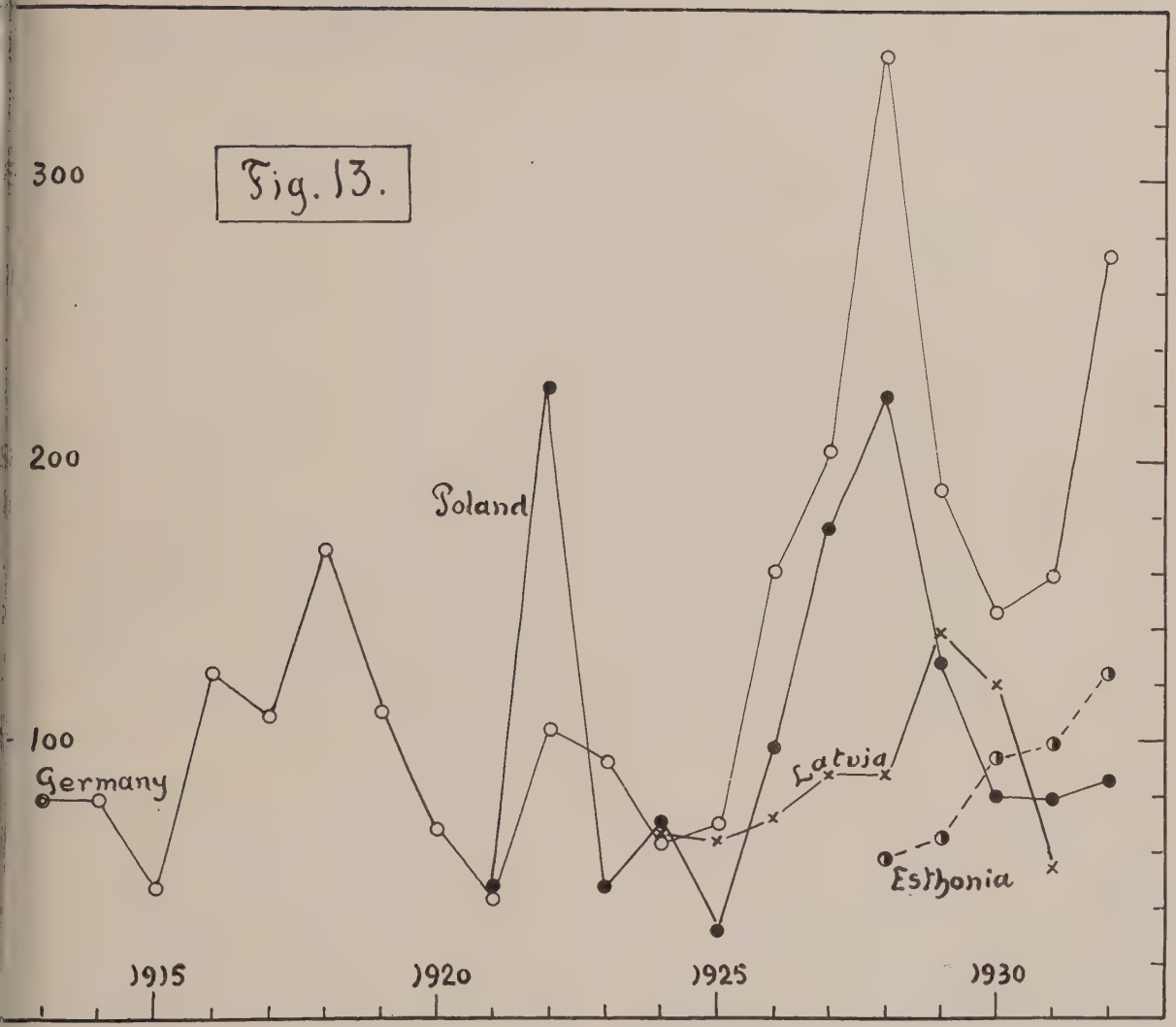

Fig. 13. Quantities (metric tons) of catches in south-eastern Baltic.

ıe returns for 1916 and 1925 were, in any case, ıd. Statistics from the Esthonian and Latvian ıtes which relate to the later years show that e variations in catch are spontaneous and do ot show any great similarity either among themlves or in comparison with other Baltic salmon sheries.

Quite different conditions are met in the anish, German and Polish fisheries. As regards anish salmon fishery, which almost entirely takes ace off the coast of Bornholm, we find variations catch which are very similar to those of Blekinge ıd Scania except that the rise or fall in the nount of catch in Bornholm come either a year efore or a year after it occurs in Blekinge, a ndition to which I will refer later.

As regards returns in Germany and Poland we can state that any considerable changes in the German catch are, with few exceptions, felt in the Polish returns as well. Both have their best years in 1927—1929 and 1932 as also their worst years in 1925, 1930—1931. Generally speaking variations during the period 1925—1932 agree fairly well with those of Sweden and Denmark, while no similarity seems present before 1925. Whilst Bornholm and Blekinge show good results in 1915 and 1919—21, the German catches are worst in the years 1915 and 1921 and good years were met in 1913—1914, 1916 and 1922, i. e. one or more years later. We will, however, in the next chapter discuss further the changes in catch and the greater or lesser similarity of conditions in the Baltic.

Table 21. The salmon fishery of the Baltic in thousands of kilogrammes (generally including sea trout) from 1913—1932.

Year	Sweden	Finland	Esthonia	Latvia	Poland	Germany	Bornholm	Total
1913	—	117	—	—	—	78	33	—
1914	142	108	—	—	—	78	35	—
1915	157	152	—	—	—	47	58	—
1916	111	256	—	—	—	124	28	—
1917	168	166	—	—	—	108	22	—
1918	112	137	—	—	—	169	17	—
1919	214	145	—	—	—	108	72	—
1920	312	200	—	—	—	68	83	—
1921	386	245	—	—	43	43	77	—
1922	267	195	—	—	226	105	42	—
1923	258	184	—	—	48	93	41	624
1924	181	228	—	66	72	64	16	627
1925	126	308	—	64	33	71	38	640
1926	170	244	—	73	97	158	42	784
1927	276	316	—	88	176	206	67	1,129
1928	268	124	58	89	224	345	43	1,151
1929	172	135	66	140	128	191	23	855
1930	190	180	95	119	81	146	42	853
1931	363	208	99	57	81	160	63	1,064
1932	347	204	125	—	86	275	158	—
Mean	222.1	192.6	88.6	87.0	107.9	131.9	50.0	880.1
%	25.2	21.9	10.0	9.8	12.3	14.9	5.7	

4. Total returns for the Baltic.

The total amount of salmon caught in the Baltic is on an average 880,000 kg. For the period where there are complete statistics the greatest return was in 1928, 1,151,000 kg., the lowest in 1923, 624,000 kg. As regards the different countries Sweden comes first with 25.2 % of the whole, followed by Finland with 21.6 %, the last being Denmark with 5.7 %.

We must now make a comparison between the amount of river and sea fish. I assume that all salmon in the Baltic is derived from those fish who originate from the Baltic rivers. There is, as far as we know, no immigration from outside the Baltic though it is very probable that, to a limited extent, small salmon in certain years travel to other waters through the Sound. The important salmon rivers of the Baltic are, as previously mentioned, the Swedish, Finnish, Russian, Esthonian and Latvian. The return from Swedish rivers is some 148,000 kg. per annum (Table 19) or about 2/3 of the Swedish sea fishery. According to Miezis and Mannsfeld's figures the return of Latvian river salmon should correspond to about 2/3 of the Latvian sea fishery. On this basis the Latvian river fishery should be some 60,000 kg. On the same lines, and under due reservation as to possible miscalculations, the Finnish and Esthonian river fisheries can be also reckoned at 2/3 of the sea fisheries, or for Finland's ri fishery 130,000 kg. and Esthonia's some 60,000 The returns of salmon for the most import Baltic rivers would therefore be about 398,000 Considering that this figure takes no account Russia, Germany or Poland's river fisheries it is s to say that the calculation is conservative. The to for the Baltic should therefore be, for river f 398,000 kg. and for sea fish 880,000 kg. maki 1,278,000 kg. per annum. Considering that Dani German and Polish returns for their sea fisher

Table 22. Weight and calculated numb of large and small salmon caught in the Baltic.

	Catch in kg.		Mean weight		Numbe	
	large	small	large	small	large	sm
Sweden	220,000	2,000	6	1.0	36,700	2,0
Finland	192,000	—	8	—	24,000	—
Esthonia	89,000	—	6	—	14,800	—
Latvia	87,000	—	6	—	14,500	—
Poland	87,000	21,000	9	0.8	9,700	26,3
Germany	108,000	24,000	7	0.8	15,400	30,0
Denmark (Bornholm)	48,000	2,000	5	1.0	9,600	2,0
Total	831,000	49,000			124,700	60,3
	880,000				185,000	

e included without corresponding figures for eir river fisheries, we may presume that the river shery amounts to 31 % and the sea fishery to % for the entire Baltic.

As regards the number of fish the conditions e different. As previously shown the average eight of fish in the Swedish rivers is 8 to 9 kg. d this probably is the same for the Finnish, sthonian and Latvian fish. With a mean weight 8.5 or let us say 8 kg. and an annual mean tch in all rivers of 400,000 kg. we get a figure 50,000 salmon. The Baltic salmon is on the other nd generally smaller. Though these figures must very uncertain one can with the help of existing erature make the following calculation (Table 2). As to large salmon for Sweden, Esthonia, and atvia 6 kg. has been reckoned (the fish caught nerally being 2-winter salmon), for Bornholm e weight must be taken at only 5 kg., whilst on e other hand for Germany and Poland 3 to 4-inter salmon are common and give a considerably gher mean weight, which can be put at 7 and kg. respectively. As regards small salmon these e caught entirely in Sweden, Denmark, Germany d Poland. In Esthonia and Latvia this catch is ly nominal due to minimum size regulations and Finland it is still rarer. The total catch of small lmon for Sweden, as seen from table 20 and 27, n be put at about 2,000 kg. annually, this fishery taking place off East-Scania and Norrland (partly) only. Off south Scania the mean weight was from 0.7 to 0.8 kg. in 1932—1933, according to table 27. According to table 25 the length of the majority of small fish measured was about 46 to 47 cm. which, however, agrees with a mean weight of 1 kg. and the average weight may therefore be put at 1 kg. for small salmon in the south-western Baltic. In Bornholm we may reckon with a similar mean weight and a quantity of 2,000 kg. As regards Poland there are records by D i x o n according to which small salmon in the years 1924—1928 amounted to 107,600 kg. The total yields of Poland for this period being 602,000 kg., the small salmon should therefore comprise between $^1/_5$ and $^1/_6$ of the total catch. For the whole statistical period this amounts to 87,000 kg. large and 21,000 kg. small fish per annum and according to D i x o n's records the average weight was 0.8 kg. The same proportion applies to Germany.

In the Baltic therefore, as long as the present intensive fishing takes place, the annual catch should be about 125,000 large and 60,000 small salmon or a total of 185,000 fish with an average weight of 4 kg. In the Baltic with its rivers as a whole the mean figure of catch would be about 235,000 specimen, divided between river and sea fish in a proportion of about 21 % to 79 %.

III.

Salmon markings and hook-finds in the Baltic.

The survey of the fishing returns in different altic states shows, generally, similar variations d therefore should probably be based on salmon riginating from fairly similar districts. An undant year-class in the northern Swedish or innish rivers gives a plentiful return in these vers and in the south and mid-Baltic, and the verse is the case with poor year-classes.

The more important rivers being situated in the rthern and middle parts of the Baltic, whilst an portant fishery takes place in the southern stricts the salmon must originate from the north-n rivers. The results of salmon markings strongly pport this view. (Fig. 14). The earliest salmon arkings were made in 1906 in Denmark by t t e r s t r ø m who marked a number of 1-winter lmon, off Bornholm. Of these, some were caught in the summer of 1906 near Bornholm d one specimen was caught by the end of August the same year, with a weight of 1.7 kg., in the ver Ule (Finland).

German markings were made in the spring of 1919 and 1922 by H e n k i n g who experimented on a large number of 1-winter salmon off the coast of Pomerania. In the late autumn of the same year one of these fish weighing 4 kg. was caught off the coast of Bornholm, two further ones were recaptured in the spring of 1920, one weighing 4.1 kg., off Scania, and one weighing 4 kg off Königsberg. In the summer of 1920 two specimens were caught in the Kemi river weighing respectively 5.5 and 6.5 kg. The year 1921 brought two further fish, one at Lule weighing 13 kg. and one in the Ångerman river weighing 11.5 kg. Finally a fish marked 1919 was caught off Torne in the year 1924 with a weight of 12 kg. This fish had already spawned and had therefore already been up-river once. The same year a fish marked 1922 was caught in the Torne river, weighing 8 kg. In 1913 H e n k i n g marked certain smolts emigrating from the Persante river (Pomerania). A number of these were recovered both during the same and the following

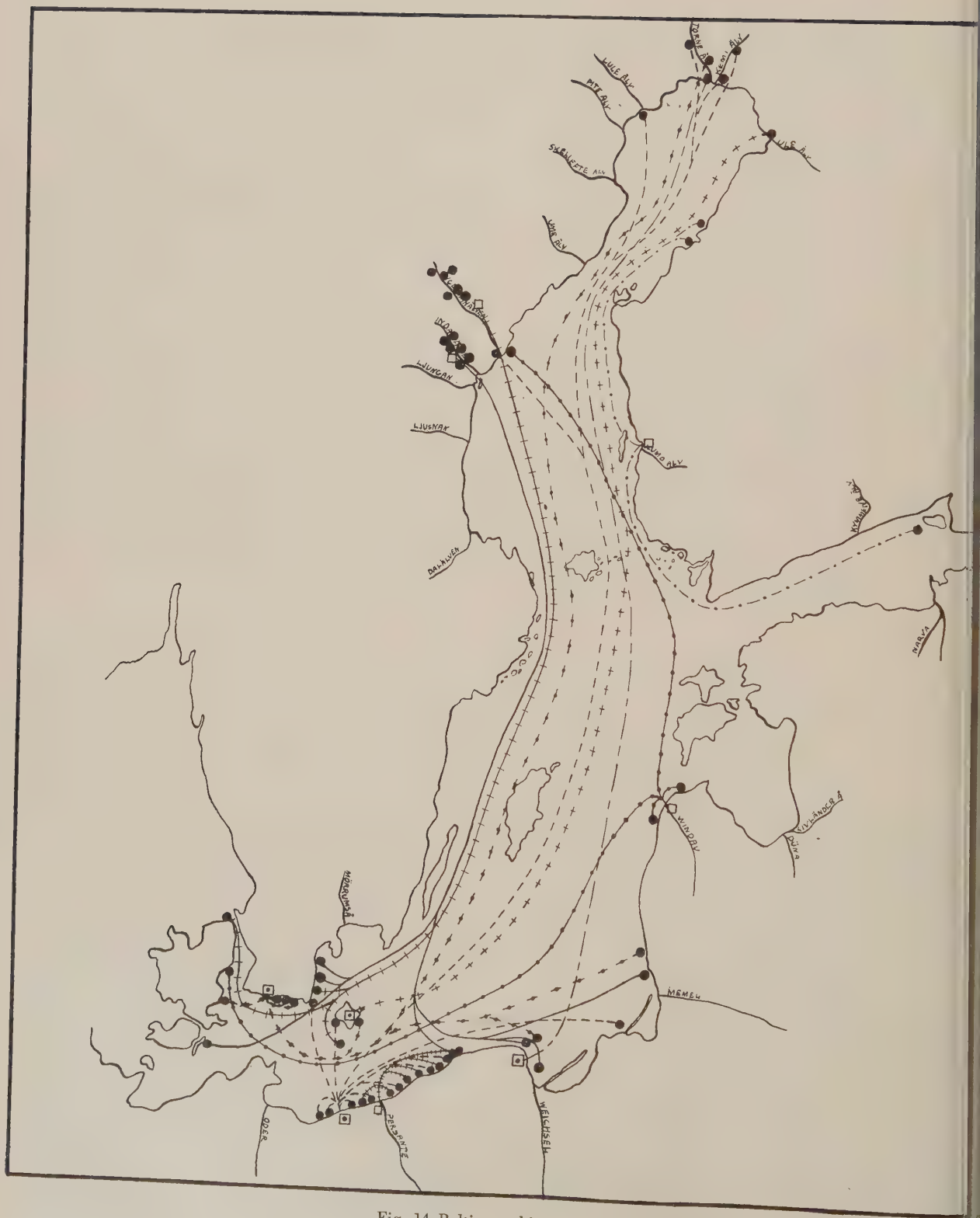

Fig. 14. Baltic marking results.

☐ Markingplace for smolts. ⊡ Markingplace for · 1 winter fish.

r, but all in the same district, although towards East.

The most comprehensive markings have, however, been the Swedish ones. Under my guidance, during the years 1924—1926, some 5,000 young were liberated in the Indal and Ångerman rivers. Of the 22 specimens recovered, 10 were found in the sea, all in the southern Baltic. Of these 5 were 45—50 cm. long and were caught: one off Scania, two off the Danish islands Zealand (north east part of the Sound) and Falster, and one off Pomerania. After 2 winters 4 further specimens of 4—6 kg. were caught, one off Scania, one off Bornholm and two off the Bay of Danzig. Finally a 3-winter fish weighing 9.5 kg. was caught at Neukuhren in East Prussia. The younger salmon were, therefore, caught in the south-western, middle-aged ones in the southern and the older ones in the north-eastern Baltic. Also 12 salmon were recaptured within these rivers.

In the months of April and May 1932 we marked a number of 1-winter fish off the coast of Scania, at Lilla Bedinge near Trälleborg. Of these there have been caught, up to now, 9 specimens, four in the summer of 1932 on the coast of Scania, all west of the marking place. Of the remaining 5, one was caught off Falster on May 5th, 1932, being 45 cm. long and weighing 0.65 kg., the second in April, 1933, off the Polish coast having a length of 53 cm. and a weight of 1.7 kg., the third fish south of Bornholm on April 17th, 1933, with a length of 71 cm. and a weight of 3.75 kg., the fourth in the Torne river on August 27th, 1933, weighing 7 kg and the fifth at Neukuhren in East Prussia on March 31st, 1934, and weighing 9 kg. It is remarkable that the salmon caught off Poland were of such poor weight.

In later years markings were made in Finland, Latvia and Poland. In 1929 in the Kumo river, mid-Finland, young fish ready for migration were marked, of these 3 were caught in the spring of 1930 weighing 0.67 to 0.8 kg., two in the north of the Gulf of Bothnia and one in the Finnish Bay. Of the Finnish salmon marked during the years 1925—1928 none have been recovered.

As regards fish marked in Latvia and liberated in Windau in May 1930 one was caught in August 1930 at Brämö (Sundsvall) in mid-Norrland weighing 0.77 kg. and a further specimen in September 1931 at Amager (Copenhagen) of 76 cm. length and 4.85 kg weight. Other fish marked in the Riga district have all been recovered off the neighbouring coasts.

The Polish markings which comprise migrating smolt and 1-winter specimens have only produced one return, which was marked at Hela on March 31st, 1933 (length 40 cm.) and caught in the Torne river in late July of the same year having then a length of 50 cm.

On several occasions even kelts used in artificial fertilization have been marked. Of these specimens few have been caught, and most in their spawning rivers or near to mouth of the rivers, although in some cases such fish made longer migrations before being caught. This applies to a fish in the Ule river, which was caught at Nykarleby and one marked, in the Kymmene river, in September 1905, weight 6.5 kg., which was recovered in May 1907 near Memel, East Prussia, having obtained a weight of 10 kg.

The results of these markings in the Baltic show that smolts marked in the northern Swedish rivers migrate to the southern Baltic, remaining there some years, before returning to spawn in their original rivers. Certain factors seem to show that smolts from the Swedish rivers first visit the south west district of the Baltic and proceed east on the increase of sea age. Smolts from the southern Baltic and German rivers appear usually in the neighbourhood of their home rivers. After spawning in their northern rivers of origin those that survive appear to seek again the southern Baltic. Exceptional migrations are proved by specimens marked at the Kumo river and at Windau.

We should see these markings supported by the hook-finds. Many years ago it was observed that the fish caught in the northern part of the Bay of Bothnia carried hooks of a type used in the southern Baltic and inversely big fish caught in the southern Baltic carried hooks of northern origin. During recent years Willer and Quednau have organized systematic investigations of hooks and reached very interesting conclusions. They have been able to show that hooks carried by fish in the south-eastern Baltic are partly of the type used in that district and partly, and more often, of the type used in Bornholm. Further hooks of the south-eastern Baltic type have been found in fish caught off Öland and in the Bays of Bothnia and Riga. Most interesting is it to note that hooks of the Ångermanland (mid-Norrland) type have been found in salmon caught off the coasts of Esthonia and Latvia, whilst a hook of the Gothland type has been found in a fish caught near the estuary of the Düna (Fig. 15).

The results of these observations, as also the markings of fish, show that the fish from Swedish and Finnish rivers migrate between the Bay of Bothnia and the middle and south Baltic, whilst those in the south Baltic seem to have a tendency to migrate from the west to the east, and that Esthonian and Latvian salmon can be found in the Bay of Bothnia and off Gothland.

In a further chapter we will analyse more closely the salmon races in different districts in order to ascertain, with the help of results obtained by the markings and hook observations, the migrations of the salmon within the Baltic.

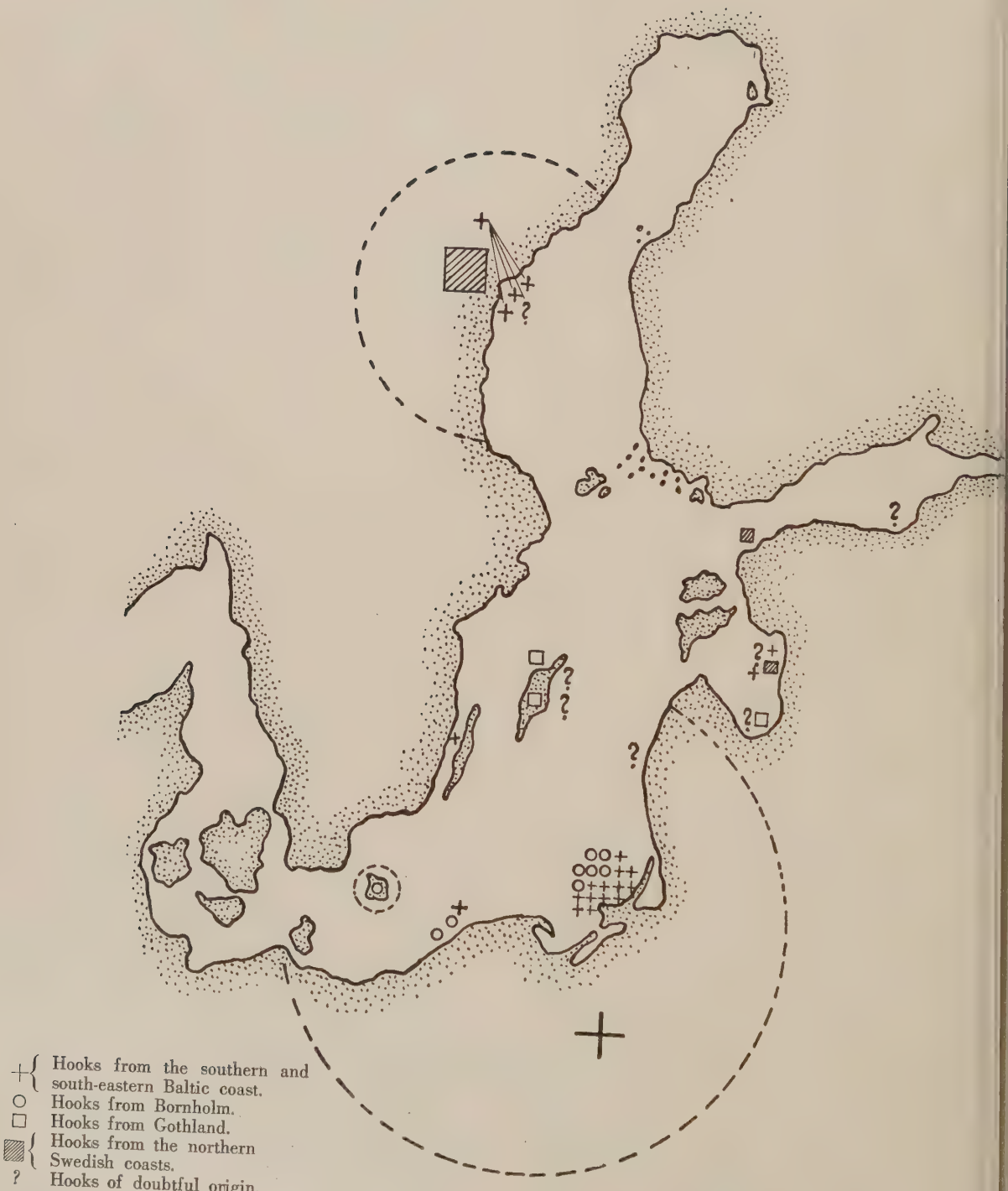

Fig. 15. The result of hook finds in the Baltic during later years. (Cf. Quednau in Ztschr. f. Fischerei, XXX, 4, 1932).

IV.

The salmon's occurrence and migrations in the Baltic.

In the foregoing I have given an account of river and the sea age of salmon in the Baltic ers.

With the help of these data and the statistics, also the results of markings and hook-finds, I l now endeavour to clear up the question of the gration of salmon in the Baltic. In this connection ention is drawn to table 32 and Fig. 16. A glance his figure will show that in the rivers the smolt increases gradually from 2 years in the southern 3, 4 or 5 years in the northern, in the sea three generally, the age. Any marked deviation to be nd is adverse to those in the rivers, i. e. the olt age is longer in the southern than the north- parts of the Baltic and the Gulf of Bothnia. s fully confirms the assumption derived from rkings and hook records and proves that salmon ght in the Baltic originate mostly from the thern Swedish and Finnish rivers. On this plan can proceed considerably further. The dif- ence in sea life must be dealt with separately l we should begin with fish during 1-st winter.

Small salmon.

As stated, salmon of one winter are caught stly in the south, off the coasts of Scania, Born- m and, especially, Germany and Poland, as merly in Esthonia and Latvia. On the shallow dy coasts, which are usual in these parts, there a winter and spring season for fishing small salmon, i. e. salmon which have been one year or less in the sea and which come into these coasts to feed on sandeel, other small fish, and Crustaceans. This fishery varies greatly from year to year. In south Scania for instance (Table 32) the percentage of 1-winter fish was high in 1930—1931, but low in 1929 and 1933, 1932 being a middle-year. There are several reasons for this, partly due to the fact that these small fish, as confirmed by local fishermen, are greatly affected by conditions of wind and current, and the weather in general, and therefore, under certain circumstances, are found in great quantities. Thus eastern and southern winds drive these fish towards Scania while reverse winds cause them to disappear, like the sandeel, and presumably to be present on other coasts. This was for example the case in 1932 when large quantities of these fish were caught off Bornholm whilst few only appeared off the Scania coast. Difference in abundance of year-classes plays also a great part, and doubtlessly the very abundant presence of small salmon in the springs of 1931 and 1932 and to a certain extent in 1930 can be ascribed to abundant year-classes, a detail to which we will refer again later. In the other parts of the Baltic, for example in Norrland, small salmon have been caught during certain years but in much smaller quantities than is the case in the south.

The smolt age of 1-winter fish is shown in table 23 and Fig. 16. One is struck by the fact that these

Table 23. Smolt age, percentage (and number) of salmon caught in the sea of 0.9 to 1.9 winters.

	Year of capture	River age 1.	2.	3.	4.	5.	Total
Täfteå, Summer	1930	—	18.2 (2)	81.8 (9)	—	—	11
— —	1931	—	52.1 (73)	43.6 (61)	4.3 (6)	—	140
— —	1932	—	19.0 (4)	81.0 (17)	—	—	21
Ulvöarna, Autumn	1931	3.0 (1)	66.7 (22)	30.3 (10)	—	—	33
Bremön, Summer-Autumn .	1930	—	40.0 (8)	45.0 (9)	15.0 (3)	—	20
— — .	1931	—	44.3 (35)	53.2 (42)	2.5 (2)	—	79
Gnarp — .	1930	—	60.0 (9)	26.7 (4)	13.3 (2)	—	15
— — .	1931	—	70.0 (7)	30.0 (3)	—	—	10
Grisslehamn, Spring	1931	—	50.0 (7)	42.9 (6)	7.1 (1)	—	14
Gotland, Autumn	1932	—	7.9 (3)	78.9 (30)	13.2 (5)	—	38
Simrishamn, Spring	1932	—	6.7 (1)	86.7 (13)	6.7 (1)	—	15
Malmöhus län, —	1929	—	—	100.0 (7)	—	—	7
— —	1930	—	18.7 (26)	76.3 (106)	5.0 (7)	—	139
— —	1931	—	20.6 (29)	70.9 (100)	7.8 (11)	0.7 (1)	141
— —	1932	—	10.0 (6)	55,0 (33)	35.0 (21)	—	60
— —	1933	—	33.3 (2)	16.7 (1)	50.0 (3)	—	6
— —	Mean	—	17.8 (63)	70.0 (247)	11.9 (42)	0.3 (1)	353
Poland (acc. to Dixon)...	1925	—	—	80.0 (56)	20.0 (14)	—	70
— — ...	1933	—	—	15.0 (15)	53.0 (53)	32.0 (32)	100
	Mean	—	—	41.7 (71)	39.4 (67)	18.9 (32)	170

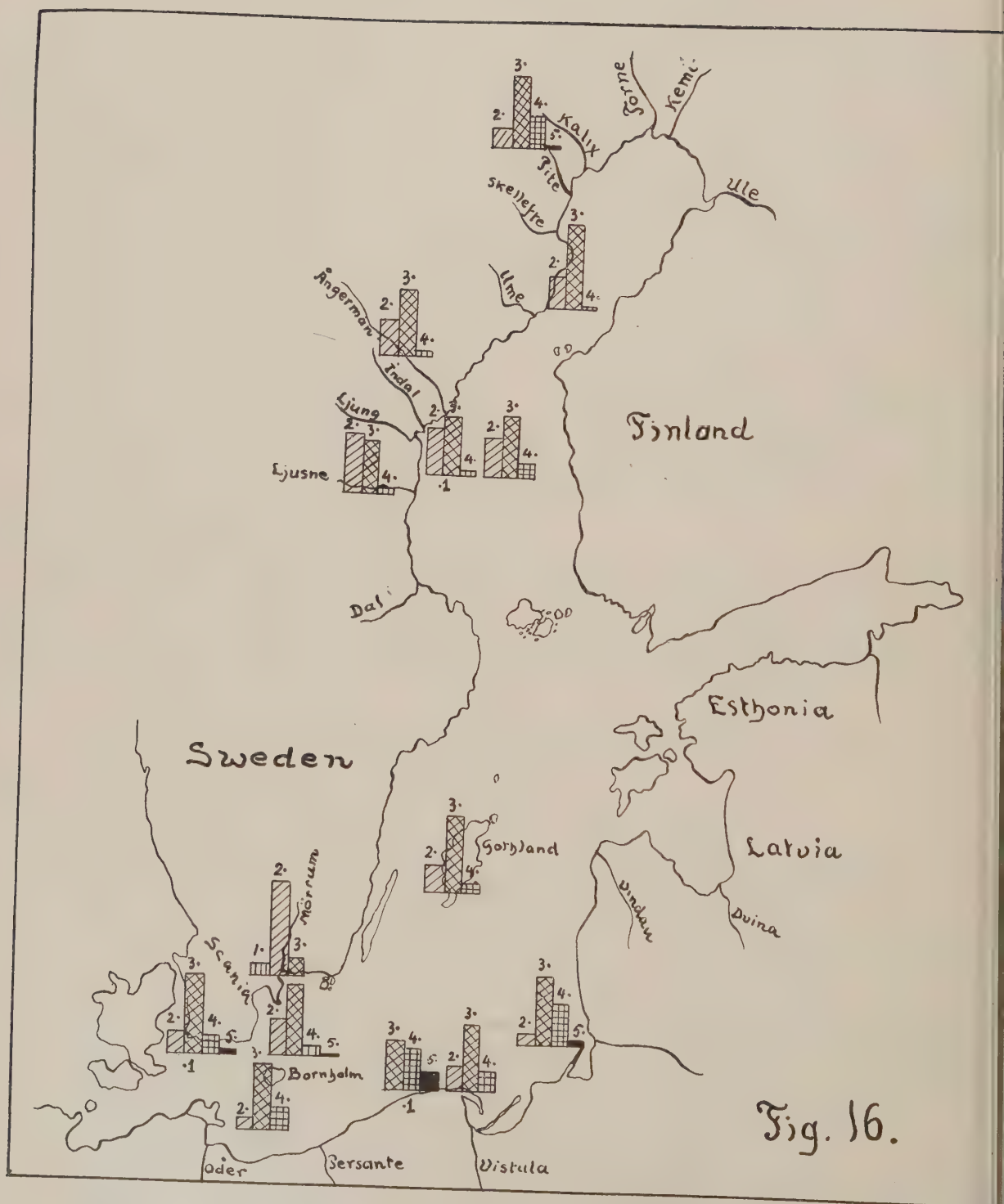

Fig. 16. Smolt ages observed in catches in different parts of the Baltic. · 1 = 1-winter salmon only; other columns all sea ages, (cfr. Fig. 1).

Table 24. Percentage of the total at different smolt ages of salmon caught in Swedish rivers and off the coast of northern Sweden.

	% of catch	Percentage as to the single river 1·	2·	3·	4·	5·	Percentage as to total 1·	2·	3·	4·	5·
in the river											
Torne	10.5	—	5	76	19	—	—	0.5	8.0	2.0	—
Kalix	5.5	—	11	66	23	—	—	0.6	3.6	1.3	—
Lule	11.5	—	13	60	26	1	—	1.5	6.9	3.0	0.1
Skellefte	1.5	—	42	55	3	—	—	0.6	0.8	0.1	—
Ume	3.5	—	42	55	3	—	—	1.5	1.9	0.1	—
Ångerman	5.0	—	33	65	2	—	—	1.7	3.2	0.1	—
Indal	4.5	—	40	59	1	—	—	1.8	2.7	—	—
Ljung	0.5	—	63	37	—	—	—	0.3	0.2	—	—
Ljusne	5.0	—	51	47	2	—	—	2.5	2.4	0.1	—
Dal	2.5	—	63	36	1	—	—	1.6	0.9	—	—
Mörrum	5.0	8	80	12	—	—	0.4	4.0	0.6	—	—
in the district of											
Norrbotten	28.5	—	10	67	22	1	—	2.8	19.1	6.3	0.3
Västerbotten	9.0	—	42	55	3	—	—	3.8	4.9	0.3	—
Västernorrland	4.0	—	36	62	2	—	—	1.4	2.5	0.1	—
Gävleborg	2.5	—	51	47	2	—	—	1.3	1.2	—	—
Upsala	0.5	—	63	36	1	—	—	0.3	0.2	—	—
Stockholm	0.5	—	63	36	1	—	—	0.3	0.2	—	—
Total	100.0						0.4	26.5	59.3	13.4	0.4

n in the southern Baltic show a high smolt age ile the age is relatively low on the Norrland sts. The reverse is the case in the rivers. Review- conditions in the south Baltic, the smolt age fish caught in the south-western is somewhat er than that known in the northern rivers, (or ilar to those from the rivers Ume and Lule), ilst in Poland it is almost higher than those in northern rivers. As regards salmon in the th-western Baltic it seems obvious that it origin- s in the rivers mentioned, which show similar olt ages, but it does not seem possible that these ers can provide such quantities as are here in estion. The smolt, therefore, must originate also other rivers. In order to arrive at the mean gratory age shown by the stock of salmon in estion, rivers with higher as well as lower smolt , i. e. rivers north and south of Ume and Lule, e to be included as possible supplier of the r stock. As we know that smolts are rarely ght in Norrland we can assume that the smolt grating from all, or most, of the Swedish rivers south (cfr. marking results) and collect in the th-western parts of the Baltic off Scania, Born- m, Pomerania etc. In this case the smolt age all fish caught off the coast of Norrland, and its rivers, as well as in the Mörrum river should about the same as those found off Scania. To estigate this table 24 has been compiled. Tables and 20 give the distribution in percentage of ght in the northern provinces (Norrbotten— ckholm) and its rivers. Though the mean weight somewhat varied in different rivers I have all same calculated that this percentage distribution can be applied to the whole. In each river, or province, the percentage has been calculated for different smolt ages and the total arrived at gives the percentage distribution for the whole range of fish in question.

The age of smolt for Swedish rivers corresponds fairly well with the smolt age of the 1-winter fish caught off the coast of Scania, the latter however being somewhat higher. These results would however admit of the assumption that fish from all the Swedish rivers go south. Should for example fish from the most northerly rivers not be found here, or fish from the Baltic rivers, with a lower smolt age, in their first winter show themselves in these parts of the Baltic, the migratory age of fish caught off Scania would be considerably lower than is the case; and should the smolt from the rich northern, especially Finnish, rivers collect in the south-western Baltic, the age at migration would be, inversely, considerably higher than at present.

Details relating to the middle parts of the southern Baltic coasts are non-existent. We must therefore turn to the south-eastern Baltic, or to the Polish and East Prussian waters, where D i x o n's figures will be found in table 23. In these parts, as previously mentioned, the age of smolt is considerably higher than in the south-western Baltic. The explanation must be that these salmon originate from rivers with such a high smolt age as is the case in the most northerly Swedish and Finnish rivers only. These rivers actually have stocks of smolts rich enough to provide for the present salmon fishery in the south-eastern Baltic.

TIEFENKARTE
20 m-Grenze
50 „ „
100 „ „
200 „ „
300 „ „
400 „ „
0 — 20 m
20 — 50 „
50 — 100 „
100 — 200 „
über 200 m
126 Maximaltiefen in m
o24 Beobachtungsstation
Leuchttürme:
UI = Ulkokalla
N = Norrskär
S = Söbuskär
M = Märket
B = Bogskär
U = Utö
H = Hangö
P = Porkala
Feuerschiffe:
P = Plewna
N = Nahkiainen
H = Helsingkallan
S = Snipan
St = Storkallegrund
R = Relandersgrund
A = Äransgrund
Bottnische
See
Wiek
Torneå
Kemi
Luleå
Piteå
Skellefteå
Ulcåborg
Brahestad
Gamla Karleby
Jakobstad
Ny Karleby
Umeå
Wasa
Hernösand
Sundsvall
Kaskö
Kristinestad
Björneborg
Hudiksvall
Ljusnan
Gefle
Dal-Elf
Hangö
Helsingfors
Ekenäs
Stockholm
Nyköping
Landsort
Dagö
Hapsal
Reval

As stated above the smolt age for small salmon ght off Poland is a little higher than that olished for the northern rivers, and small fish he coast of Scania show a higher smolt age the mean age for the whole of Sweden. This robably due to the fact that the scale material the rivers does not show sufficient numbers mall salmon with the highest smolt age due n to the already discussed inverse ratio between s spent in the river and in the sea. The age smolt therefore most probably is somewhat er than that calculated, and this difference ld thus be the greater the more north the river tuated, due to an increasing number of ascend- grilse.

The smolt age found for 1-winter salmon ght in the southern Baltic supposes, quite clear- hat fish from the Swedish rivers seek the south- ern parts while fish from the north Finnish rs seek the south-eastern parts of the Baltic. y spread probably to the middle districts of southern Baltic where they are then found as ixture of Swedish and Finnish salmon. That is the case is shown by the marked 1-winter , caught off Pomerania, and later re-caught in erent northernmost rivers, and in the Ångerman r, as also those marked off Bornholm and re- tured in the Ule river. Occasionally, salmon travel through the Sound, this is shown by lts of marking experiments and confirmed by fact that smolt caught at the north coast of nia show a higher age than those from neigh- ring rivers. On the other hand proofs of salmon migrating to the Baltic from the Kattegat are -existent.

Before proceeding to further investigations of apparently peculiar distribution of Swedish and h Finnish salmon after migration we will take third Baltic district, namely the Norrland coast Sweden. Here catches of 1-winter salmon are r. In certain years fishing for small salmon taken place in different places of the Gulf of nia, — in recent times during the years 1925, 0 and 1931, during which years considerable ntities of small fish of nearly one (in autumn) 1 to 1.5 (spring and summer) winters were ght.

The interesting point here is that the catch often sists of fish with a low migration age (Table which is pretty regularly divided between 2 3 years. The explanation may be that the fish inate from the more southerly of the Norrland rs. As, however, the northernmost rivers are of h greater importance as salmon rivers it would ery peculiar if causes, which retain the smolts special northern rivers, should not influence ion in other Norrland rivers. If this were the the age of smolt should be higher and similar he one found on the coast of Scania. Another anation therefore seems more probable, namely, that during the years that small salmon have been caught on the northern coasts these fish consist partly of salmon from the northern rivers who have remained in their home waters and, partly, of fish from other rivers with lower migration age who have also sought these districts. The rivers in question would most probably be those of south Finland and especially Esthonia and Latvia. That smolt from these rivers wander north and north-west is shown both by the fish caught in Ångermanland and north Finland, marked in the Kumo and Windau rivers, and of larger salmon, carrying hooks originating from Ångermanland and caught off the Latvian coasts. Many factors, therefore, point to the possibility of Esthonian, Latvian and even south Finnish salmon going north during certain years into the Gulf of Bothnia, and the causes will be discussed later. Generally it is to be assumed that fish from the south Finnish rivers which, as compared to north Finnish and Esthonian and Latvian rivers even, are of minor importance, undertake short wanderings only, probably to the Esthonian coast. Similarly Esthonian and Latvian salmon generally remain in their home waters. This appears probable partly from the fact that these coasts offer very similar conditions to the south Baltic, which is visited by Swedish and Finnish smolt, partly from Esthonian and Latvian statistics which have no counterpart in other Baltic districts.

We have been able to show with some certainty, that the salmon from the Swedish and north Finnish rivers during their first winter seek the south Baltic, the Swedish salmon chiefly the south-west, the north Finnish the south and mostly the south-east parts, further that usually the Esthonian and Latvian fish pause in their home waters and finally during certain years the salmon migrating from the Norrland rivers pause occasionally off the northern coast, where it is sometimes joined by certain contributions from Esthonian, Latvian and even south Finnish stocks. We must now find the reasons of these strange wanderings, and as a start we must consider the smolt after migration and their requirements for environments. On this point we know nothing definite, but we may suppose, that their requirements first of all are a plentitude of food, but also high temperature and salinity which probably stimulate feeding and indirectly increase the growth.

That the salmon, our most rapidly growing fish, requires plentiful food seems certain. It seems further not unnatural that this fish, when arrived in the sea, i. e. the different environments into which its migrations have led it, feels a certain desire just for a change of the environments experienced until now. These changes are, in the first place, the salinity and the higher temperature of the sea water. There are, as stated, no investigations on this point. It is striking that those salmon, that

never enter the sea, never show the same growth as salmon in the sea, although in many cases they have equally good feeding conditions. (This is proved by the fact that sea trout in similar water reach a very good size). An experiment by Henking should be mentioned where river trout which were liberated in the sea showed a very good growth, being clearly stimulated by the warmer and more saline water of the sea. Assuming that a certain salinity and high temperature are beneficial to newly migrated smolt it is easily explained that smolts from the northern rivers seek the south. A fairly warm and salt water is found in the southern Baltic only. Salinity here reaches some 8—10 ‰ and in deeper waters is as high as 15—20 ‰. This district extends from Scania-Bornholm, in an easterly direction to Latvia. At the same time salinity at the surface and at 50 m. depth in the Gulf of Bothnia reaches only 3 to 3.5 ‰. The temperature increases going from north to south especially in the warm seasons as shown in table 33.

Whether the smolt is attracted by warmer and more saline waters and therefore move from the northern to the southern Baltic, or not, it is certain that they seek shore districts with good food conditions. The food of migrating smolt and of somewhat older salmon has been made a subject of research by Henking on the Pomeranian coast and is found to consist chiefly of *Gammarus* and small *Ammodytes*, partly also of insect larvae and *Idothea*. The food of 1st winter salmon, investigated by Henking and Dixon as also by myself, seem to still consist of *Gammarus* but chiefly of *Ammodytes*. Investigations into the sea bottom fauna of the Baltic (Hessle, Segerstråle, Thulin) reveal that particularly *Gammarus*, and also insects, chiefly *Chironomus*, are limited to the coastal districts with depths of 10 to 15 metres, and are found in increasing quantities from the inner districts of the Gulf of Bothnia southwards to the Åland Sea and the Bight of Stockholm. From here a decrease seems to take place until we reach the more southern part of the Baltic with its high sea bed production. Precisely similarly is the development of plankton contents: increasing from the inner Bothnian Sea to the south, and with decreased production in mid-Baltic, and correspondingly on the whole we find an increase of plankton feeding fish, mostly small herring (Hessle and Vallin) but probably also sandeels which, however, also live on sea bed food. Under normal conditions it seems that the access to food for salmon during their first winter, and later, increases, in the Baltic and Bothnian Sea, from north to south and from deep to more shallow water.

A glance at Fig. 17, showing the depth in the northern Baltic, shows that the inner part of the Gulf of Bothnia contains vast banks of 1 to 20 m. depths, which continue, along the coast, to Kvarken and along the Finnish side to the Åland S At Kvarken the two districts almost meet. In Gulf of Bothnia deep water extends to the estu of the Kalix as also the Finnish Bight contain channel of deep water. Further south again m shallow water prevails which continues around greater part of the Baltic.

The question now is by which way do the sm proceed in their migration in order to fulfil th local requirement to the fullest extent. Let consider first the salmon from the Swedish a Finnish rivers entering the Bothnian Bay; th probably stay at first near the home-estuaries wh they live on *Gammarus* and fry of small fish. T food is, as mentioned, only found on the shall coasts and is more plentiful as one goes sou Smolt from the Swedish estuaries of the Bay Bothnia, who migrate in the early summer, ha on their own coast a restricted shallow area operation as also a low temperature and probal seek the south immediately, following the coast li thus arriving in the south-western parts of t Baltic, where they find more extensive areas of t required districts for plentiful food and suital temperature and salinity. How quickly these r grations south are made is unknown, and curious enough no salmon have been caught in fishi gears on the coast before by the end of the fi winter.

We proceed now to the most northerly rive the Kalix, Lule, Torne, Kemi and Ule whi together furnish the greatest supply of salmon the Baltic. On migration from these rivers, whi most probably takes place in the early and fu summer months, the fish certainly finds extensi shallow coastal districts but not of the rich fo conditions which are obtained further south. Th therefore, probably attracted also by the warm and more saline water, quickly go south. Due small differences between river and the sea wat in these districts, in all probability, smolt fro these rivers have a stronger instinct to proce south than fish from south Norrland and sou Finland. On the principle that during migrati contact is kept with the coastal grounds mention the result would be that (Fig. 17) smolt from t Lule and (partly) Kalix and Torne rivers wou follow the Swedish coast, whilst smolt from t Torne (partly), the Kemi, Ule and Finnish rive would follow the Finnish coast. The southgoi northern salmon following the Swedish coast is l and by joined by the previously mentioned sm from southern Norrland rivers and still furth south by the Mörrum smolt and these fish unit form the stock of small salmon caught at t Scania, Bornholm and Pomeranian coast and already shown this stock has a migration age th agrees fairly well with that of the entire Swedi stock.

Salmon from the north Finnish rivers we mu

me continue to follow the Finnish coast, cros- the mouth of the Bay of Finland, rather than ure to pause in its cold water, less saline and tively poorer in food conditions, a certain portion may prefer to follow the shelf of this and presently reach the Baltic coast. On this the fish find similar food ground, warm and water conditions as in the south western Baltic Scania. This accounts for the mixture of Fin- and earlier migrated fish from Latvian rivers. er Finnish salmon, on the other hand, proceed he less populous coasts of Poland and Germany. migration is presumably rapid, as already in ober and November fish of 30 cm. are caught Poland and Pomerania. As shown above Esth- an and Latvian salmon are not found here the son being, probably that this fish has not the e migratory urge as the Swedish and Finnish mon. The reason would appear to be that the her north the river is situated the lesser are the al differences and therefore the greater the inctive migratory urge to more varied districts. olt in the south and south eastern Baltic rivers find near their points of migration good ding and other conditions do not require to ke long migrations and have probably never n affected by any greater migratory instinct. s fact is known to be the case through markings de on fish from the Persante river. Whilst no edish or Finnish marked salmon are ever caught r their own rivers, great numbers of marked non from the Persante are recaught both after rter as well as longer periods either near or in ir original river estuaries, although generally in lightly easterly direction. In other words con- ons being favourable, the smolt having found ndance of crustacea and fry on which to feed e n k i n g) similar results have been found off coast of Latvia and near the estuaries. smolt 20—30 cm. often being caught which would be grants but which have remained in their own ers. Finnish smolt on the other hand did bably not find sufficient food in their own ers and have therefore most likely emigrated to honian coastal waters.

It has been mentioned that in certain years, h as 1925, 1930 and 1931 small salmon have n caught not only in the south Baltic but also the Norrland coast, and that the latter fish a lower age at migration than those in the th Swedish rivers. This sporadic appearance of ll salmon, which we have already stated, must ne partly from the Norrland rivers partly from Esthonian and Latvian, possibly also Finnish rs can to a certain extent, as is the case at the st of Scania, be due to entirely local conditions, n as southern and south-western winds which ve the sandeel and the salmon towards this st, but some further explanation seems called This may be due to conditions of temperature.

Table 33 shows that in 1925 and 1930 the temperature both in the spring and summer months was 1—4 C° above normal, as was also the case in the autumn of 1924 and 1929. Probably salinity was for this reason somewhat higher and the access to richer food greater than in colder years. The theory that higher temperature drives the most important winter-salmon-food, the sandeel, towards the coast and also affects the movements of the fish itself would account for the probability that in the years 1924 and 1929 Norrland smolt during the autumn were enticed by this high temperature to stop and to return to the Bay of Bothnia during the following warm spring and summer in 1925 and 1930, where they drifted towards the coasts assisted by wind conditions. Simultaneously the high temperature would have hastened the maturity and the return migration of salmon with 1 or 2 winters in 1926 and 1931 respectively. It is also probable that many of the smolt of 1925 and 1930 were prevailed upon to remain in the Norrland waters and thus contributed to the catch of small salmon during the autumns of those years.

The high temperature of 1925 and 1930 seems also to have influenced the Latvian and possibly the Finnish smolt and caused them, by way of Kvarken, to go north until they arrived at the Swedish coasts. In this case the relatively low age at migration of small salmon on the Norrland coast is explained as also the strange results of markings of the Finnish and Latvian salmon in 1930.

However in the year 1931 were also plenty of small salmon caught on the Norrland coasts, although the temperature was not high but more inclined to be low. This may be accounted for by the high autumn temperature of 1930. Whilst the autumn of 1925 was relatively cold, 1—2 C° below normal which caused fish to migrate south, the autumn temperature of 1930 was warmer or 1—2° above normal. It is therefore probable that salmon which had migrated in 1930 and which originated from Swedish, Esthonian or Latvian rivers remained in the Bay of Bothnia during the winter of 1930/31 and contributed to the catch of small 1-winter salmon during the following year, both on the coast and, though less than in 1925, in the rivers. Also was made in many parts of Norrland in the autumn of 1930 a large catch of small salmon and weighing ½—1 kg. they were obviously in their first year of sea life i. e. spring smolts from 1930. In 1925, which was not followed by a rich small-salmon year in 1926, the main catch was made in the early summer, and according to O l o f s s o n's records in the autumn of 1925 but few small salmon belonging to the same year of migration were caught.

Table 25.

Number and length of salmon measured in various years off the coast of Malmöhus län.

Length in cm.	1-winters 1905-1907	1929	1930	1931	1932	1933	Total
34	—	1	—	—	1	—	2
36	—	—	—	—	2	—	2
37	—	—	—	—	2	—	2
38	—	1	—	—	1	—	2
39	—	—	—	—	2	—	2
40	2	2	1	1	1	—	7
41	4	1	4	1	4	—	14
42	1	1	11	6	4	—	23
43	7	2	12	6	6	1	34
44	17	—	17	12	6	1	53
45	16	—	23	24	3	3	69
46	20	1	29	25	5	1	81
47	19	—	23	25	6	—	73
48	18	1	20	29	6	—	74
49	16	—	18	31	7	—	72
50	7	—	17	15	8	—	47
51	7	—	5	11	4	—	27
52	2	—	8	10	2	1	23
53	8	—	3	6	—	—	17
54	2	—	1	6	1	—	10
55	2	—	1	2	2	—	7
56	2	—	—	2	—	—	4
57	—	—	1	2	—	—	3
58	1	—	1	—	—	—	2
59	—	—	—	—	—	—	—
60	—	—	—	1	—	—	1
Total	151	10	195	215	74	7	632
						53.7 %	

Length in cm.	2-winters 1905-1907	1929	1930	1931	1932	1933	Total
65	—	—	—	1	1	—	2
66	—	1	—	1	1	—	3
67	—	—	1	1	—	—	2
68	—	—	1	1	—	—	2
69	—	2	4	3	—	3	12
70	—	3	—	—	1	2	6
71	—	4	2	6	—	1	13
72	—	8	—	7	1	2	18
73	1	5	—	5	3	6	20
74	—	13	5	3	1	5	27
75	—	9	3	11	2	3	28
76	—	5	6	7	—	2	20
77	—	5	3	11	1	3	23
78	3	9	4	22	3	7	48
79	2	8	5	20	4	7	46
80	—	9	3	24	2	3	41
81	1	9	—	12	2	3	27
82	1	4	4	8	4	2	23
83	2	7	2	12	5	3	31
84	1	5	1	12	9	3	31
85	1	1	1	10	6	1	20
86	2	3	1	6	6	1	19
87	1	1	1	2	5	—	10
88	1	—	—	7	6	—	14
89	—	—	1	6	2	2	11
90	—	1	—	4	5	—	10
Total	16	112	48	202	70	59	487
						41.5 %	

Length in cm.	3 to 4 winters 1905-1907	1929	1930	1931	1932	1933	Total
91	—	1	—	1	2	—	4
92	—	2	—	—	4	1	7
93	—	—	—	2	4	1	7
94	—	1	1	2	4	—	8
95	—	1	—	—	4	—	5
96	—	—	—	—	—	—	—
97	—	—	1	—	—	—	1
98	—	1	—	—	—	—	1
99	—	—	—	—	—	—	—
100	1	—	1	1	—	—	3
101	—	—	—	—	—	—	—
102	—	—	—	1	—	—	1
103	—	—	—	1	1	—	2
104	—	1	—	—	1	—	2
105	—	—	2	—	1	—	3
106	—	1	1	—	—	—	2
107	—	2	—	—	—	—	2
108	—	—	—	—	1	—	1
109	—	—	—	—	—	1	1
110	—	—	—	1	—	—	1
111	—	—	—	—	—	1	1
115	—	—	—	—	1	—	1
116	—	—	—	—	1	—	1
117	—	—	—	—	2	—	2
120	—	—	1	—	1	—	2
Total	1	10	7	9	27	4	58
						5.0 %	

lmon of two winters and over.

'e will discuss now the salmon during its d and later winter and will commence with outh-western parts of the Baltic. On the coast almöhus province the largest part of the catch sts of 1st winter salmon. Table 25 shows the e for different years of catches off the coast uth Scania. Of these 632 specimens or 53.7 % 34—60 cm. long (1st winter), 487 or 41.5 % 90 cm. (2nd winter) and 58 or 5.0 % 91—120 (3rd and 4th winter). Of 760 fish caught and nvestigated on the same coast there were 353 5.4 % 1st winters, 378 or 49.7 % 2nd winters, 29 or 3.9 % 3rd or 4th winters (Tables 23 and Small salmon are clearly in the majority off coast of Scania, but 2-winter fish are very mon. Salmon of 3 and 4 winters are rarer in district.

f we examine the catches made in the provinces Kristianstad and Blekinge, we find (Table 32) here fish of two (spring) or nearly 2 (autumn) ers are in the majority. There are few nter fish and 3-winter salmon are, with some ptions, not so common as the 2-winter variety. Puka Bay and Simrishamn in 1932 the number 3-winter salmon was somewhat larger and at nholm these salmon were in 1932 more com- than the 2-winter variety. The proportion of nd 3-winter fish in these parts was 336 to 166 2 to 1. Fish caught in the south western Baltic therefore either of one winter or more usually 2 winters. 3-winter fish are common in certain rs, due to the above mentioned current and wind ditions, and fish of 4 and 5 winters are very ommon.

Age at migration of 2-winter fish seems lower n that of one-winter specimens (Table 26). In möhus province 2-year smolt amount to 30 % ainst 17.8 %), 3-years to 60 % (against 70 %) 4-years to 9.6 % (against 11.9 %). The same he case of salmon from Kristianstad and in a ıter degree from Blekinge. In Bornholm catches y the age at migration is higher, and higher n than 1-winter salmon caught off Scania. In Bornholm data, embracing one year only, this n migration age may be fortuitous, a supposition ngthened by the high migration age of older non even on the Scania coast during the same r. (Table 26).

The explanation of this low age at migration in salmon of higher sea age must be due to an ixture of 2 or more winters old individuals n a lower age at migration or to the disappear- e from these districts of fish of higher migration

Both factors probably play their part. kings and hook findings have shown that vian salmon — of low migration age — in ain years undertake longer journeys and visit south western Baltic in their second winter. the other hand the conditions shown on page 10 causing inversely long periods of residence in rivers and sea lead to a successive disappearance of fish from these parts of the Baltic. As a result salmon from the northern rivers and those with a high migration age from southern rivers commence leaving their districts in the southern Baltic earlier than fish from the southern rivers and fish from the northern rivers having a low age at migration — a confirmation of previously mentioned deductions. At the same time the Mörrum river salmon, with its lower age at migration, sets a certain mark on the number of 3-winter fish still remaining in these parts of the Baltic (Puka Bay, table 26).

We may now take it for granted that the salmon which during its first winter immigrates to the south western Baltic generally speaking remains in these waters where to some extent it is joined by Esthonian and Latvian salmon. By the end of the second winter but more particularly during its third and fourth winter it emigrates again and especially is this the case with specimens of high migrating age.

The question is: at what season do they emigrate and what direction do fish take when migrating from the south-western Baltic to their spawning rivers. The fish, entering the river after 1 winter must naturally move rapidly from the southern to the northern Baltic a fact definitely proved by salmon marked in Bornholm and Poland and recaptured during the same year in the Kemi and Torne rivers. The number of grilse is however small, the majority of maiden fish entering the rivers after two and three winters. The great number of 2-winter salmon caught in the southern Baltic seems to indicate that all salmon, even those preparing to leave, remain in these waters until the end of their second winter.

At this time a number of fish must find their way northwards, while the remainder do this at the beginning of their 3rd winter travelling very rapidly to their northern spawning rivers. Many hook findings point to a quick journey from one place to another, and also the catches, for example in 1933 moving from Bornholm to Gothland in a few weeks. The fact that fishing returns in the south western Baltic generally correspond with those in Gothland and northern Sweden points to quick northerly migration during which it approaches Gothland. West and east of Gothland, where the mid-Baltic salmon fishing mainly takes place, a large number of 2-winter fish are caught. Most frequently an almost even number of 2 and 3-winter fish are caught here (in autumn ·1+ and ·2+ and in spring ·2 and ·3 specimens), although the majority are mostly 3-winter specimen (H e s s l e 1923). It is therefore very probable that salmon of about 2 winters caught off Gothland are fish which are migrating for their spawning grounds after 2 winters mostly spent in the southern Baltic. The fish migrating in their 3rd or 4th winter do rarely visit Gothland earlier. This being the case

Table 26. Percentage (and number) at different sm

District	Year	River age 1·	2·	3·	4·	5·	No. sp. inv.
		% (No.)	% (No.)	% (No.)	% (No.)	% (No.)	
Västerbotten							
Obbola, Summer	1930	—	35.0 (14)	62.5 (25)	2.5 (1)	—	4
— —	1931	—	17.8 (11)	80.6 (50)	1.6 (1)	—	6
—	Mean	—	24.5 (25)	73.5 (75)	2.0 (2)	—	10
Täfteå, Summer	1930	—	17.9 (5)	82.1 (23)	—	—	2
— —	1931	—	24.4 (32)	71.8 (94)	3.8 (5)	—	13
— —	1932	—	9.4 (6)	70.3 (45)	20.3 (13)	—	6
—	Mean	—	19.3 (43)	72.6 (162)	8.1 (18)	—	22
Holmön, Summer	1931	—	8.8 (13)	79.0 (116)	12.2 (18)	—	14
— —	1932	—	8.1 (7)	76.5 (65)	15.4 (13)	—	8
—	Mean	—	8.6 (20)	78.0 (181)	13.4 (31)	—	23
Västernorrland							
Ulvöarna, Summer	1931	—	100.0 (1)	—	—	—	
Bremön, Summer-Autumn	1930	—	100.0 (1)	—	—	—	
— — —	1931	—	44.4 (4)	44.4 (4)	11.1 (1)	—	9
— — —	1932	—	21.4 (3)	64.3 (9)	14.3 (2)	—	14
—	Mean	—	36.0 (9)	52.0 (13)	12.0 (3)	—	25
Alnön, Summer	1930	—	53.3 (8)	40.0 (6)	6.7 (1)	—	15
— —	1931	—	50.0 (12)	50.0 (12)	—	—	24
—	Mean	—	51.3 (20)	46.2 (18)	2.5 (1)	—	39
Gävleborg							
Gnarp, Summer	1930	—	40.0 (4)	60.0 (6)	—	—	10
— Spring	1931	—	22.2 (2)	77.8 (7)	—	—	9
— —	1932	—	34.2 (13)	55.3 (21)	10.5 (4)	—	38
—	Mean	—	33.3 (19)	59.6 (34)	7.1 (4)	—	57
Upsala							
Grisslehamn, Spring	1931	—	66.7 (2)	33.3 (1)	—	—	3
Gothland							
Spring	1932	—	12.3 (8)	75.4 (49)	12.3 (8)	—	65
Autumn	1932	—	40.0 (18)	60.0 (27)	—	—	45
	Mean	—	23.6 (26)	69.1 (76)	7.3 (8)	—	110

2-winter fish should be more numerous in Gothland than 3-winter ones, which is not the case. The salmon which after two winters leave the south western districts but do not enter the rivers before the 3rd or 4th winter must therefore remain in some other part of the Baltic, but before answering this question we must first examine the results of investigations in the south eastern Baltic.

We have said before that off the Polish coast small 1st-winter salmon are caught forming about $^2/_3$, in numbers, of the total catch. Dixon and Willer have both proved that specimens of 3 or more winters are more numerous than those with 2 winters only. Whilst small salmon off the Polish coast show a high migration age (table 23) that of large salmon is lower (table 26). The difference here is much more marked than in a similar case in the south western Baltic. The explanation is however the same; emigration of old smolt individuals and immigration of young-smo specimens. Due to the previously mentione inverse ratio between life in river and sea a com paratively high proportion of this salmon, whic have a considerably higher migrating age tha those off Scania, commence their wanderings to th spawning rivers as early as their 2nd summer a sea; and this explains the usually large catch o small maiden salmon in the Torne and Kemi rivers Dixon also informs us that small salmon caugh in Poland often have well developed gonads point ing to early maturity. We have proofs of the rapi migration of small salmon from the Polish coast to the northern rivers through that in the Torn river (see page 29) by the end of July 1933 caugh fish marked in the same year off Poland. Severa facts make it probable that a relatively larg

s of salmon caught in the sea of 2 or more winters.

ct: River or sea	Year	River age 1.	2.	3.	4.	5.	No. of spec. invest.
		% (No.)	% (No.)	% (No.)	% (No.)	% (No.)	
ar							
nd, Spring	1933	—	39.1 (9)	60.9 (14)	—	—	23
nge							
lskrona, Spring	1926	10.0 (1)	70.0 (7)	20.0 (2)	—	—	10
lshamn, Spring	1926	—	40.0 (22)	58.2 (32)	1.8 (1)	—	55
— Autumn	1926	—	42.1 (8)	57.9 (11)	—	—	19
— Spring	1931	—	32.4 (11)	58.8 (20)	8.8 (3)	—	34
— Autumn	1931	—	34.7 (8)	60.9 (14)	4.3 (1)	—	23
—	Mean	—	37.4 (49)	58.8 (77)	3.8 (5)	—	131
aviken, Spring	1925	—	53.5 (23)	46.5 (20)	—	—	43
ianstad							
höbukten, Spring	1932	—	21.2 (7)	72.8 (24)	3.0 (1)	3.0 (1)	33
arishamn, Spring	1932	—	21.2 (18)	62.4 (53)	16.4 (14)	—	85
— —	1933	—	26.1 (24)	70.6 (65)	3.3 (3)	—	92
—	Mean	—	23.7 (42)	66.7 (118)	9.6 (17)	—	177
höhus							
ious places, Spring	1929	—	40.5 (45)	55.9 (62)	3.6 (4)	—	111
— — —	1930	1.9 (1)	30.2 (16)	62.3 (33)	5.6 (3)	—	53
— — —	1931	—	23.9 (22)	68.5 (63)	7.6 (7)	—	92
— — —	1932	—	24.4 (22)	52.2 (47)	22.2 (20)	1.1 (1)	90
— — —	1933	—	27.9 (17)	64.0 (39)	8.2 (5)	—	61
— —	Mean	0.2 (1)	30.0 (122)	60.0 (244)	9.6 (39)	0.2 (1)	407
holm							
ing	1932	—	16.6 (22)	61.7 (82)	21.8 (28)	—	132
nd (hooks)	1925	—	40.0 (40)	47.0 (47)	13.0 (13)	—	100
— —	1933	—	33.0 (33)	54.0 (54)	13.0 (13)	—	100
— (driftnets)	1928	—	14.0 (14)	69.0 (69)	17.0 (17)	—	100
— —	1933	—	10.1 (10)	67.7 (67)	22.2 (22)	—	99
—	Mean	—	24.3 (97)	59.4 (237)	16.3 (65)	—	399
Prussia	—	—	8.3 (8)	57.3 (55)	33.3 (32)	1.0 (1)	96

ber of small salmon of the type caught in the h eastern Baltic does not remain there but rtake their spawning migration partly during r 2nd summer at sea, partly during their second er, in order to reach the spawning grounds r two winters. Those left form the catch of d 3-winter salmon which, as mentioned, consist ish of a relatively high age at migration. On unt of the difference in migration age between e older and the younger fish there would seem e amongst the former a larger amount of fish rivers with a lower migratory age than found ne most northerly ones. An admixture of Estho- and Latvian salmon may here be considered ible, as also of salmon from the south western ic (Swedish). In the former case the age at ration should appear to be reduced, and cially the number of 2-winter fish to be more common than 3-winter ones. The migration age is, however, not very low, and it is a peculiar fact that, inversely to the south western Baltic, 3-winter fish are more usual than those of 2, whilst fish of 4 and even 5 winters are quite common. These facts, in conjunction with the conditions in the south western Baltic and the results of markings and hook findings, clearly point to an admixture of salmon from the south western Baltic. Fish from the Swedish rivers which during their first winters are mainly found in the south western Baltic but migrate from there in their 2nd winter and still remain in the southern Baltic, have a tendency to move eastward. They therefore set their mark more and more on the salmon, already present and originating from the Finnish rivers, resulting in a middle high migration age and above all an increasing number of individuals of a high sea life. The

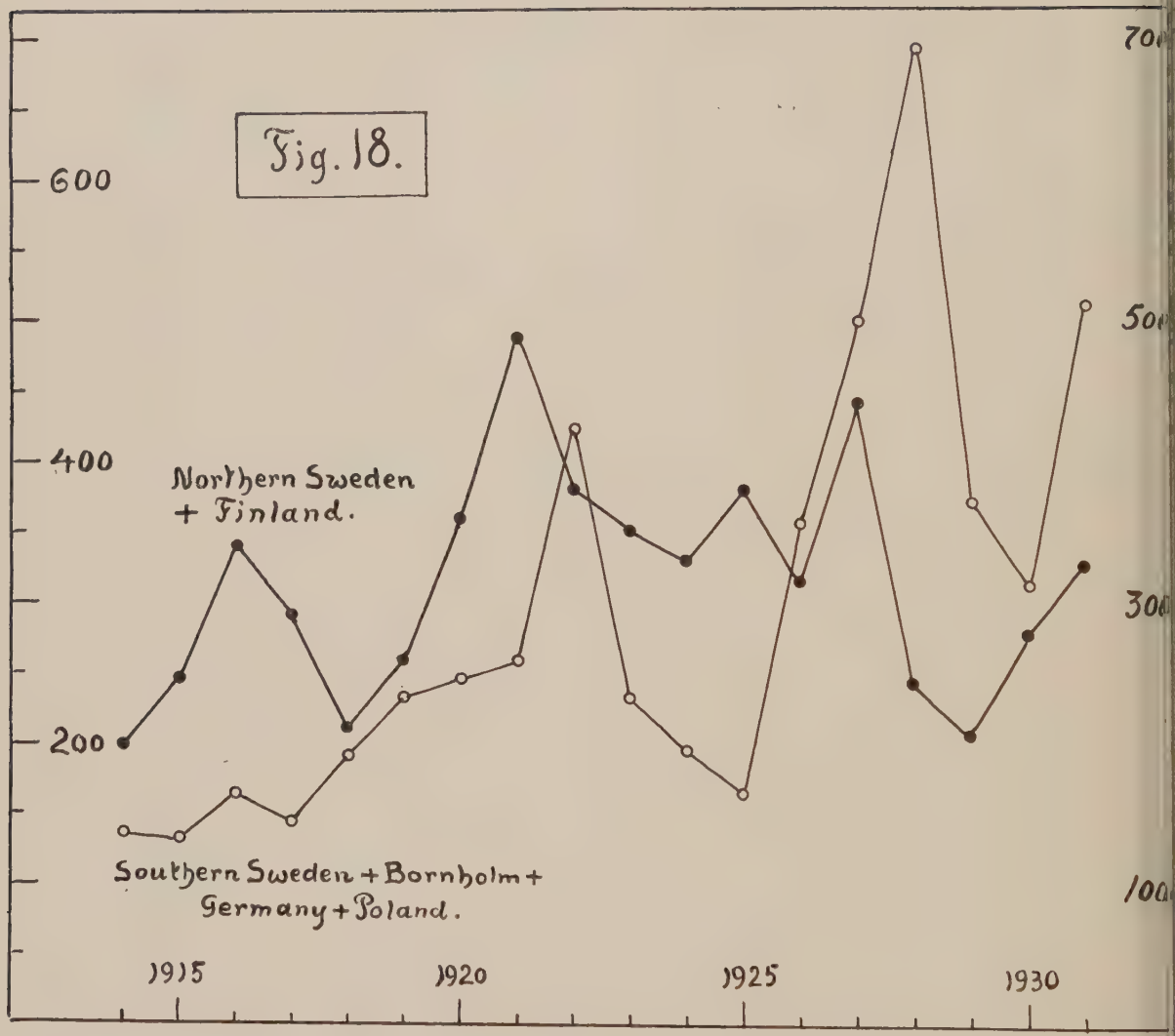

Fig. 18. Total quantities (metric tons) of catches in the northern and the southern Baltic.

reason for salmon with increasing sea life moving from south west to south east can be due, as suggested by Willer, to the easterly currents.

Regarding migration age a certain difference is found between those fish caught on hook in the late autumn and early winter and those caught in drift nets during the late winter. The former fish show a lower smolt age than the latter ones and further considerably lower than that in the south western Baltic.

This is generally the case in all years and is also usual for Gothland. Probably the reason is that the Esthonian and Latvian salmon wander more during the autumn and winter and thus reach different parts of the Baltic reducing the me migratory age whilst in late winter they approa their spawning rivers in order to enter them ea in the spring. Among Polish salmon caught in late winter, as with Gothland fish caught in spring, the age at migration is generally somew higher than in the south western Baltic, pointing a more complete admixture of Swedish and Finn salmon.

Salmon examined in East Prussia by Will being mostly caught in late winter and of a len 70—125 cm. show a high migration age, strang enough higher than those of the same sea age cau off Poland (table 26). The cause of this

bably that the small salmon from the Polish sts, which have not gone north during their nd winter, have, like the Swedish salmon, a dency to move east before they begin their actual wning migration. Thence they follow the coast become the object of the East-Prussian fishery. s explains observations: of a high smolt age of mon caught off East-Prussia, a lower one off and (in the late winter) and the lowest in the th western Baltic.

Both Dixon and Willer have found a high rcentage of salmon with spawning marks (G-mon) varying between 12—20 % (see page 14). is may be due to the fish from the northern ers, who survive the spawning season, again nder towards the south and especially the south-tern districts of the Baltic. We have proof of s by a salmon marked in Finland being recaught East-Prussia. This is probably due to a relatively ly spawning migration in the most northerly ers which is the cause of a lower post-spawning rtality in these rivers than in those where spawn-r takes place later. This being the case some mon caught off East-Prussia, and which have viously spawned, should be mended kelts which ring their first winter have been on the same stal grounds but already in their second summer sea commenced their spawning migration. A atively large number of mended kelts from the rthern Baltic rivers can also contribute to the gh migration age amongst East-Prussian fish with nger sea life.

From the theory that a large quantity of fish m the south-western Baltic move to the south-stern part and remain in these parts some nsiderable time before proceeding on their awning migrations, it is possible to explain the fference in the statistics of the Baltic in general om the German and especially the Polish fish-ies. The variations in the two countries agree mpletely, but often the maxima are reached some-at later, even some years later, than in the south-estern and in the northern districts. These fish-ies including a number of individuals of 3, 4, 5 d even more winters belonging to the year-classes which the majority spawn in their 3rd and 4th ar, less frequently in the 5th and very rarely ter the 6th, a rich year-class from northern rivers ll appear later in the south-eastern than in the uth-western Baltic. A comparison between the es of these salmon and those in the spawning vers actually shows that in the south-eastern Baltic ch large quantities of older salmon are caught and 5-winters) that few of these fish survive d have the opportunity of further spawning. nally, kelts from the northern rivers re-emigrate the south-eastern Baltic and these several causes plain the above mentioned maxima in salmon tches, sometimes several years later than cor-sponding maxima in other parts of the Baltic. These conditions are more visible, if a comparison is made between the total of fishing returns for the southern Baltic (Scania, Blekinge, Bornholm, Germany and Poland) and those for Norrland and Finland (see graph on Fig. 18).

On general lines the following conclusions are definitely arrived at. Salmon originating mainly from the Swedish rivers remain in the south-western Baltic during their second winter, after which a certain proportion moves north in order to enter their northern spawning rivers, whilst the remainder, i. e. those fish that are not due to spawn until after 3 and 4 winters, remain in the south-west or migrate partly to the eastern districts of the southern Baltic. Of the small salmon originating chiefly from the Finnish rivers in the south-eastern Baltic a relatively large number return already as grilse to the northern spawning rivers. The remainder who probably form the majority stay in these waters and with increased number of winters tend to become more and more mixed with Swedish fish coming from the south-west and in the autumn with Esthonian and Latvian fish. At times they move in an easterly direction in order to reach via East-Prussia and Gothland their spawning rivers. Of these a number again return to the south-eastern Baltic.

It is necessary in order to establish my foregoing assumptions of the subject of migrations particularly in the south-eastern districts of the Baltic to make further investigations as to the age distribution of salmon on the Polish, the East-Prussian, and above all the Esthonian and Latvian coasts and rivers as well as in the Finnish rivers. It would be of special interest to know whether those salmon, sometimes found in smaller streams in the south-eastern districts, as is the case in Great Britain (see page 10) show a higher smolt age than in the adjacent rivers. It cannot, at the present stage, be definitely denied that small salmon caught off Poland originate from such rivulets although the majority must originate from the most northerly rivers. It is, however, obvious that fish from all northern rivers, generally speaking, spend their period of growth in the southern Baltic, and that they only move north in connection with spawning and then form part of the catch off Gothland and the Norrland and Finnish coasts.

As regards those salmon of two or more winters caught on the Norrland coasts, they show, with the abovenamed exceptions, a migrative age corresponding to that of the salmon of the adjacent rivers, though on the whole it seems somewhat higher. This points to the fact that a number of these fish originate from the more northerly rivers having a high age at migration. As this applies for example to the coast of Västerbotten the salmon here probably consist partly of salmon in course of migrating to the adjacent spawning rivers and partly of salmon en route for their northern rivers

in the Gulf of Bothnia. On the coasts of south Norrland the catch shows a somewhat higher migration age than that prevailing in the adjacent rivers without being as high as that of the most northerly rivers. This tends to show, apart from those fish which are proceeding towards their spawning rivers situated in the neighbourhood, that salmon are caught here on their way to more northerly spawning rivers although not to the northernmost ones.

The fish proceeding to the Bay of Bothnia seem at first to keep relatively far out to sea, and as they proceed further north to seek the coast and follow it for a certain distance before entering their spawning rivers. In any case the salmon seem neither to go straight for their home river from the open sea nor generally to follow the sh northwards. Certain indications make it proba that salmon sometimes follow the Swedish a sometimes the Finnish coast in their northe migrations. This might account for a good retu in 1925—1927, of the Finnish fishery and sim taneously a poor one on the Norrland coasts. Th is also good reason to believe that fish from Swedish rivers which have been a long time in southern Baltic and have subsequently moved e follow in their northerly migrations at first eastern shores of the Baltic, the Bay of Bothnia a only later steer towards the Swedish coa Inversely it seems not probable that the Finn salmon on migration north follow the Swedish coa

V.

Summary and Practical Conclusions.

In the foregoing chapter I have endeavoured to show, with the help, first of all, of investigations into the age and growth of fish, their outward and upward migration, length and weight etc., as also by statistics, marking results and hook finds, the possibility of forming a definite view on the occurrence of salmon and its migrations both in the rivers and in the sea. The most important point is the confirming of the existence of definite river races recognisable by growth, length and weight, as also by habits in different rivers, and further the intimate connection between the catches and the movements of fish within the northern and southern districts under discussion (see page 43). The origins of this connection lie partly in the good or bad salmon year-classes in the north Swedish and Finnish rivers which generally occur simultaneously within a relatively large district, partly in the long and fairly regular migrations in the Baltic. The result is that salmon fishery a certain number of years after a good or bad year-class in the more important rivers increases or diminishes in the southern Baltic and in the northern districts and tributary rivers, and that encroachments into the fishery or into the spawning possibilities of the salmon will be visible all over the Baltic. The results of a good or bad year-class, in spite of the divergence of smolt ages in the northern and southern rivers, will show themselves fairly simultaneously on these coasts and rivers, and are due to an inversive ratio between the salmon's time of residence in river and sea. To elucidate the effect of year-classes on salmon fishery we should analyze more closely certain of these and as a basis we take the year-classes to which good yields were due from 1919 to 1922. During the previous years the returns had be lower and more or less uniform for Sweden, h for Finland evidently there had been a good ye class, that influenced favourably the Finnish, Bor holm and German fisheries (no Polish fishe then existing) in the years 1915—1918. In 19 a large and sudden rise was noted in fishery retur for the south-western Baltic (which can possib be connected with a good year-class 1914), consis ing of 2·3 salmon and 3·2 salmon — the maj part. It was clear that a large number were process of returning, which appears in the resul off the Gothland as well as the Norrland fishe during the same year. The largest returns howev were in 1920 when the majority consisted of years old (3·3) salmon as well as a fair numb of the 1915 year-class, i. e. 5 years old specimen This year-class is especially noticeable in the retur for 1921 when 3·3 specimens distinguished th catch. The rivers as well as the coasts of Norrlan and Finland gave in the years 1921 and 1922 e cellent results, and 1922 shows good catches als in Germany and Poland, and this is undoubtedl due to migrations to the south-eastern Baltic o older fish.

The next good year-class was 1922. Of th year-class a number emigrated in the spring o 1924 and formed part of the catch of 1-winte salmon in the spring of 1925. As formerly explaine that year produced in Norrland a quantity of smal salmon of which unusually many 2-year smolt On the coast of Scania, however, the catch of smal salmon was relatively small. The high temperatur of the autumn of 1924 and the spring of 1925 ha obviously retained the large number of smolts i Norrland. The later part of 1925 was, on the othe

, not particularly warm, and probably a large ber of salmon migrated that winter to the , where in the spring of 1926 a relatively e amount of 2-winter fish were caught off ia (Table 27). A number of them remained

le 27. The salmon fishery in kilogram- and, for the years 1932/33, the number ght off the coast of Malmöhus (Scania) ivided into large and small salmon.

	Large, 3—20 Kg. Weight	(No.)	Small, 0.5—2.5 Kg. Weight	(No.)	Total weight
24[1])	155		624		779
25	118		334		452
26	2,730		4,313		7,043
27	781		542		1,323
28	4,484		778		5,262
29	2,393		678		3,071
30	886		729		1,615
31	7,867		7,530		15,397
32	2,487	(423)	519	(782)	3,006
33	8,067	(2,201)	596	(819)	8,663

) For the years 1924/27 for 2 districts only, for the s 1928/30 for 3 districts, and for the years 1931/33 he whole coast (4 districts).

Norrland and entered the rivers in the summer 926 as 2-winter maiden salmon (see page 12). 3-year smolt from the year 1922 were caught irst winter fish in large quantities off the coast Scania in the spring of 1926. The year after, 7, they had apparently moved to other parts of southern Baltic where good catches were ob- ed, whilst the Scania and Blekinge fisheries e inferior results. This is shown also by table giving statistics in different German districts. he year 1927 the salmon fishery was, chiefly, lized in the eastern districts, whilst in other rs the fishery was carried on more towards the t. As formerly said this is caused by the ten- cy of salmon to appear on different coasts in junction with certain wind and current con- ditions. Both small and large salmon appear to be influenced in the same direction by these conditions. A large part of the foregoing salmon of 3 river years and 2 winters and probably the majority of the 2-year smolts moved in the winter of 1926—1927 to their spawning rivers and were caught, in large numbers, off Öland, Gothland and the northern coasts as also in several rivers. The Finnish catch was also plentiful during this year.

The next year, 1928, was excellent in the whole southern Baltic, large catches being made of 3-year smolts of the year-class 1922, which had now been 3 winters in the sea and were thus due for spawning migrations during this year. This good salmon year, 1928, which benefited in the first place Germany and Poland, but also Blekinge and Scania, seems however to have greatly affected the stock. Öland, Gothland, and Norrland giving a poorer result this year, when the 1922 smolt ought to be travelling north, than in the year 1927 (see Fig. 18 p. 42). Four-year migrants, which were smolts in the spring of 1927, increased the returns of 1929, after 3 winters, of the normal German and Polish catches, but had no effect on the Norrland fisheries which, on the contrary, showed low returns. During this year salmon fishery was very localized in the middle part of the southern Baltic (Table 28).

Since 1922, there have been several fairly good year-classes until we again 1927 find a plentiful year-class, in 1929 consisting of 2-year smolts. Similar conditions prevailed as in the case of the year-class 1922 (high water temperature) a number of fish remaining in Norrland and being caught there as small salmon in 1930, and as 2-winter salmon in 1931, there, as well as off Blekinge, Scania, Bornholm and Germany, the latter having relatively good catches of small salmon in 1930 also. In 1931 however this year-class is particularly prominent being distinguished by its catches of 3-year smolts of the spring 1930. These were found partly off the Norrland coasts, but were chiefly met in the southern Baltic, where they formed the main part of the heavy catch of 1931. Thus, on the coast of Malmöhus district the catch by weight

Table 28.
The salmon fishery in the Baltic of various German provinces.

	East coast of Schlesw.-Holst.	Lübeck	Mecklenburg	Vorpommern and Rügen	Hinter-pommern	Bay of Danzig	Kurische Nehrung	Total
1926	2,770	2,820	4,880	33,900	37,070	31,060	45,760	158,260
1927	3,340	1,510	950	8,790	34,060	87,950	69,110	205,710
1928	3,250	490	1,710	90,070	141,040	54,380	53,820	344,760
1929	2,060	360	690	7,150	130,000	27,800	22,860	190,920
1930	1,800	500	1,200	10,100	44,800	52,200	36,900	147,500
1931	3,600	4,100	7,200	22,600	89,600	23,300	23,300	173,700
1932	2,300	400	1,400	25,300	85,700	96,400	66,800	278,300

was about the same for small as for large salmon which in numbers is about 6 to 9 times as many small ones. The following year, 1932, large catches of small salmon were made in the south-western Baltic, obviously consisting of 4-year smolts from the above mentioned abundant year-class of 1927. In this connection it is significant that the age investigations in Scania for 1932 show a large number of 4-year smolts (Table 23). Attention must also be drawn to the high percentage of 5-year emigrants proved by catches off Poland in the spring of 1933 and which can easily be ascribed to the rich year-class of 1927, in the northern rivers.

In the catches of large salmon this year-class appears in 1932 in the entire southern Baltic (as 2·3 and 3·2 fish) but peculiarly enough not at Gothland, which does not show good catches until 1933. In the northern Baltic the Norrbotten district shows good catches in 1931, 1932 and particularly in 1933, in the sea as well as in rivers. Also the year-class 1928 seems to have been fairly abundant, numerous small salmon appearing in the south-western Baltic (1932) and in the south-eastern in 1933.

With reference to the reasons of varying good and bad year-classes I have in an earlier work shown that this is partly due to hydrographic factors in the river, the most important being the fall of the water level in winter whereby a number of eggs are left high and dry or are frozen in and killed. These questions I do not propose to discuss here, their consideration being more suitable for another time.

It is obvious, however, that the appearance in plentitude of small salmon in the southern Baltic indicates the existence of one or more good year-classes, and is a prediction of good catches of large salmon during the following year, in the southern Baltic as well as in the northern and its tributary rivers. It should be remembered though that one cannot judge the abundance of the year-classes by observations from a single part of the southern Baltic, these being subject to the previously discussed influence by wind and current which send the salmon to varying coasts. For the same reasons, an abundance of small salmon does not necessarily predict a plentitude for the next year of large salmon *in the same district;* it is more likely that salmon, whether large or small, appear on one coast one year and on a different one next year (see table 27). Attention may here be drawn to the above mentioned interrelation between the fisheries of Blekinge and Bornholm.

The above discussion on the relation between the fishery in different parts of the Baltic and the various year-classes' influence thereon shows how important it is that all questions relating to salmon and its fishery in the Baltic should be treated as one unit. Too intensive fishery in the southern Baltic can affect detrimentally the catch in northern waters and decimate so intensely maiden salmon that the whole salmon populati can be affected. On the other hand the deleteri influence of industry, as well as preventive measu in the more important salmon rivers must a affect the quantity of salmon in the Baltic.

Three steps are necessary to assist the salm population of the Baltic, namely (1) minimum si (2) extended close seasons in the rivers and artificial hatching on modern lines.

There can be no divergence of opinion that is highly uneconomical and improper to catch, its earlier stages, a fish such as the salmon, wh grows quickly, has practically no enemies a obtains a considerably higher price per kg. in t larger than in the smaller variety. Neverthel small salmon are caught everywhere in the Ba chiefly in the winter and spring. In Scania a Bornholm it is customary to commence this fish by the end of March, it is best at the end of Ap and ceases at the end of May or the beginning June. After that period the small salmon disapp and are not caught again until the followi autumn and then as 2-winter fish. In the sou eastern Baltic fishery of this type takes pl somewhat earlier, namely January—May w maximum in March and April, but according Dixon small fish are caught here as early November—December.

The size of small salmon in the south-weste Baltic (south Scania) is shown in Fig. 19 bas on table 25. The greater part of the small salm caught off Scania are 45—49 cm. long, but ma are only 40 cm. whilst others reach 60 cm. In t south-eastern Baltic (Poland) fish are somewh smaller, the majority being 41—46 cm. and no over 49 cm. This is due to the earlier fishing small salmon in these waters.

As regards the size at which the salmon shou be protected one can disregard the reason which observed in other cases, namely that the fish question should have spawned once, — t "biological minimum". If this were the case t standard would be such as to bring a great pa of the fishing to a standstill. Other factors must taken into account, first of all the large differen in price between large and small salmon and t fact that small salmon, if protected, are not caug again before the next autumn, by which time th have arrived at the 2-winter stage with a weig of 3—4 kg. and during the following spri (April—May) have increased to 5 and 6 kg.

Formerly, as is known, a minimum size 50 cm. was proposed for Baltic salmon. Whi this length would prevent any young salmon bei caught in the south-eastern Baltic, it would n apply to the south-western Baltic, where abo 15 % of the young salmon reach up to 50 c Sixty cm. would appear to be the best minimu

this figure seeming to be the transition length he second winter, at the same time giving so e a weight, 2—3 kg., that the fish should reach good economic value. This size would, as gested by O l o f s s o n, be of considerably more when applied to Norrland fish than 50 cm. greater part of these having a higher measure- it than this latter figure. For the south-eastern tic it is of no importance which figure is taken. We must consider what advantages such a imum size would give. With the support of ner observations we can agree to the following: ll small salmon were protected, a number would reach the rivers where it will be the object of a further catch and in some cases will spawn and thus increase the number of their species.

The question of a minimum size for the whole Baltic has been, as is known, one of considerable discussion among International Salmon Experts, hitherto without practical result, though, the reason being chiefly that for want of close knowledge of the salmon's biology and migrations in the southern Baltic, a certain fear has been felt that those fish caught and put back into the sea would not be recaught. As I have shown above this fear is quite groundless. As regards the south-western Baltic the

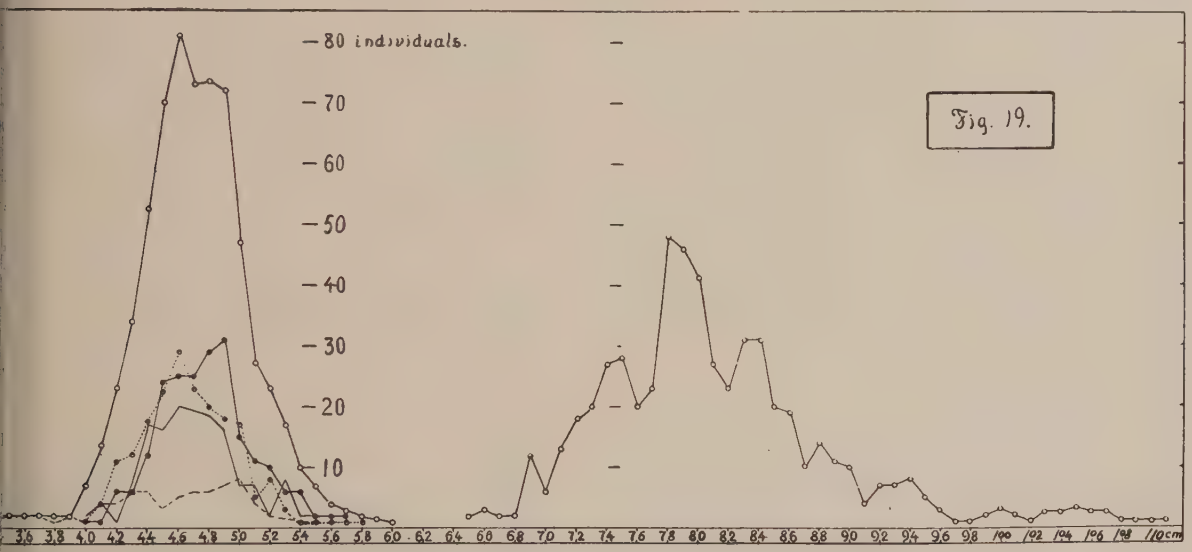

Fig. 19. Numbers at different lengths of salmon measured from catches off the coast of Malmöhus district (Scania) in the years 1905—07 and 1929—33 (cf. Tab. 25).

appear from the southern Baltic in order to ach their spawning grounds, while a number uld in one way or another disappear, being eyed on by seals etc. The majority, or let us only 50 %, would remain in the Baltic and caught there after 2 or 3 winters, or off the ast of Gothland or further north on their way to spawning grounds.

We have (page 27) reckoned the number of all salmon caught in the Baltic at 60,000 with a an weight of 0.8 to 1 kg. or a total weight of ,000 kg. At 1 crown (or the equivalent in foreign rrency) per kg. this would amount to 50,000 wns. On the presumption that all small fish protected and that 50 % of these are caught er 2 or more winters at a, low reckoned, weight 5 kg. the total catch would be 150,000 kg. × 30,000) which at 2 crowns per kg. would ount to 300,000 crowns or 250,000 crowns more n the value of the small salmon. To this must added a number of protected fish who will majority of fish caught are 2-winter ones and even in those years when small salmon are plentiful the large variety is still an important factor. These large fish must be fish which have at an earlier period been small fish operating near the coasts but which have escaped the fishing nets. It is of course clear that they have not necessarily always been on the same coast, as currents and wind drive small as well as large salmon one year in one direction another year in another. In view of the fact that fishermen sail over large areas of the Baltic and collect, from different countries and provinces, where the fish happen to be at the moment, these conditions are of no importance. The important point is that the protected small salmon remain in the south-western Baltic and can be recaught by the same fishermen who had the opportunity of taking them as small fish.

In the south-eastern parts of the Baltic the conditions are somewhat different. Here a number of small fish leave these waters to proceed north

during their second "winter" to their spawning grounds. A protection of small fish in the south-eastern Baltic would therefore be to the even advantage to the northern waters, to recruitment and to the south-eastern Baltic. It must however be restated, that a large number of small fish remain here during the 2nd and 3rd winter and can form part of the catch of Polish and German fishermen — but as older fish. To this must be added the important fact that a large amount of those fish which have spent their first winters in the south-western migrate to the south-eastern Baltic. Fishing in the south-eastern waters would therefore benefit greatly by the protection of small salmon in the south-west and can expect to increase the catches to an extent that should more than compensate for losses from emigration of small fish from their waters. It seems therefore justifiable to assume that all Baltic States would benefit by a minimum size of 60 cm.

Other objections such as that fishermen cannot distinguish salmon from sea trout, that salmon may be caught in nets intended for other fish, that fish once caught may, in certain cases, be so damaged that they cannot survive, should not weigh much against the undoubted advantage, above mentioned. Fishermen might be permitted to retain damaged fish, but it should be forbidden to transport or sell such fish in the Baltic States.

Another important point for the whole Baltic is the question of greater protection in the rivers and estuaries either through shorter fishing seasons or "holidays". It cannot be denied that the salmon which has evaded all dangers and reached its spawning ground to propagate its species for the first and probably only time in its life deserves greater protection than it receives. Certainly there is everywhere in Sweden and Finland prohibition against salmon fishery in the autumn, but the close seasons, and size of the prohibited districts, vary greatly and weekly "holidays" exist in Sweden only. It is however a general experience that a precise limitation of river fishery is of the greatest importance for the maintenance of the salmon population. The Wye River in England is the best example of this. Above all holidays should be an exce method of getting salmon of all sizes and type to the spawning grounds, while a greater limita of the fishing season would not always work effectively, the smaller fish being spared, w the larger ones which often collect at high wa would not be protected. It is reasonable only to catch mending kelts who remain until the sp in the rivers. This fish has, as is known, very l value whilst once it has re-fed in the sea it giv good return and may even come back to spawn limiting of the season to only 3 or 4 months in e river and certain areas of the estuaries toge with a minimum of two holidays each week wo appear to be acceptable in all Baltic count Protection in the rivers should even extend salmon who have as yet not migrated for the time, i. e., all parrs and smolts. In spite of present prohibitions against the catch of the p such fishing still takes place quite extensively better control and above all effective instructio to the harmful effect of destroying parrs sho have the effect of checking this practice.

Finally all Baltic States should combat the influence, caused by the action of industry on w conditions, by compulsory compensation damage as far as possible from the indus primarily by contributing to the artificial sal hatching on modern lines in the waters affecte well as in other still untouched waters so that districts could be used for the development salmon fry. In this connection consideration sho be given to the possibility of constructing sal passes by which the salmon may ascend in wa which, through the hindrance of nature, they unable to reach on the usual way. As the Ba can be considered, where salmon is concerned, one lake or river, it follows that all countr which fish these waters, should contribute artificial hatching or other means of increas the salmon population as is the case in the Rh and the Vistula.

In this connection a draft proposal for a vention between the Baltic States for impro fishery conditions has been prepared.

Vorschlag zu einem Übereinkommen

zwischen

Deutschland, Dänemark, Estland, Finnland, Lettland, Litauen, Polen, den Russischen Sowjet Staaten und Schweden

über die Regelung der Lachsfischerei im Ostseegebiet.

Artikel I.

Die Bestimmungen dieses Übereinkommens fin- Anwendung auf die ganze Ostsee, die Belte den Öresund mit eingerechnet, wie auch den tnischen, den Finnischen und den Rigaischen erbusen und alle in diese Gebiete mündenden isse.

Artikel II.

In allen in die Ostsee mündenden Flüssen und benflüssen, in die der Lachs aufsteigt, soll jede chsfischerei alljährlich auf die Dauer von acht Monaten verboten sein.

Artikel III.

In allen in die Ostsee mündenden Flüssen und benflüssen, in die der Lachs aufsteigt, soll die chsfischerei, mit Ausnahme der Hakenfischerei ngelfischerei), auf die Dauer von 48 Stunden jeder Woche oder 96 Stunden in jeder zweiten che eingestellt werden. Die Geräte sollen dann geöffnet sein, dass der Lachs ohne weiteres ssieren kann.

Artikel IV.

Für das ganze Ostseegebiet (vgl. Artikel I) soll Mindestmass für den Lachs von sechzig (60) timeter gelten, von der Schnauzenspitze bis zur tze der Schwanzflosse gemessen; unter diesem ss dürfen Lachse weder gefangen noch trans- tiert noch in den Verkehr gebracht, verkauft r gekauft werden. Sofern Lachse unter diesem ndestmass gefangen und verletzt worden sind, es den Fischern gestattet, diese zu behalten und ihrem eigenen Haushalt zu gebrauchen.

Artikel V.

Zur Hebung des Lachsbestandes im Ostseegebiet soll darauf Bedacht genommen werden

1) dass die natürlichen Laichplätze den aufsteigenden Lachsen möglichst zugänglich gemacht und vor Raubfischerei geschützt werden;

2) dass künstliche Lachszucht von allen an der Ostsee-Lachsfischerei beteiligten Staaten betrieben wird, wobei die Staaten, die keine Lachsflüsse von Bedeutung haben, anstatt selbst Lachszucht zu betreiben, Beiträge zur erhöhten Lachszucht in den Staaten, wo dies möglich ist, zahlen sollen.

Artikel VI.

Die Regierungen der beteiligten Staaten werden die zum Vollzuge dieser Übereinkunft erforderlichen Vorschriften erlassen und deren Übertretung mit angemessenen Strafen bedrohen, auch das zur Handhabung dieser Vorschriften erforderliche Aufsichtspersonal bestellen.

Durch gegenwärtige Übereinkunft wird die Befugnis der einzelnen Staaten nicht ausgeschlossen, für ihre Gebiete strengere Bestimmungen zum Schutz der Lachse zu betreffen.

Artikel VII.

Jede Regierung der beteiligten Staaten wird für ihr Gebiet einen Bevollmächtigten bestellen.

Diese Bevollmächtigten werden sich die von ihren Regierungen getroffenen Anordnungen über die Lachsfischerei im Ostseegebiet gegenseitig mitteilen und von Zeit zu Zeit zusammenkommen, um über die zur Förderung der Lachsfischerei im Ostseegebiet zu ergreifenden Massregeln zu beraten.

Table 29. Length of river-caught salmon of various age-groups.

Age	Year	Kalix cm. (No.)	Lule cm. (No.)	Ume cm. (No.)	Ångerman cm. (No.)	Indal cm. (No.)	Ljung cm. (No.)	Ljusne cm. (No.)	Dal cm. (No.)	M cm
2·1+	1926	—	—	—	—	—	—	—	—	6
	1927	—	—	—	—	—	—	—	—	5
	1928	—	—	—	—	56.7 (3)	—	—	—	5
	1929	—	—	—	—	—	—	—	—	
	1930	57.5 (2)	61.6 (5)	—	—	—	—	63.0 (1)	—	
	1931	65.5 (2)	62.5 (2)	—	61.4 (8)	—	—	61.5 (2)	60.0 (1)	7
	Mean	61.5 (4)	61.9 (7)	—	61.4 (8)	56.7 (3)	—	62.0 (3)	60.0 (1)	6
3·1+	1926	—	—	—	66.0 (2)	—	—	—	—	
	1927	—	—	—	—	—	—	59.0 (1)	—	5
	1928	56.0 (2)	—	—	—	—	—	—	—	5
	1929	—	—	—	—	—	—	—	—	
	1930	61.5 (13)	57.6 (33)	59.0 (1)	—	—	—	—	—	
	1931	56.0 (1)	57.0 (8)	60.0 (3)	62.0 (1)	—	—	68.0 (1)	—	
	Mean	60.5 (16)	57.5 (41)	59.8 (4)	64.7 (3)	—	—	63.5 (2)	—	5
4·1+	1926	—	—	—	—	—	—	70.0 (3)	—	
	1927	—	—	—	—	—	—	—	—	
	1928	53.0 (3)	—	—	—	76.0 (1)	—	—	—	
	1929	—	—	—	—	—	—	—	—	
	1930	56.8 (5)	60.3 (7)	—	—	—	—	—	—	
	1931	—	—	65.0 (1)	—	—	—	—	—	
	Mean	55.4 (8)	60.3 (7)	65.0 (1)	—	76.0 (1)	—	70.0 (3)	—	
1·2+	1926	—	—	—	—	—	—	—	—	8
	1927	—	—	—	—	—	—	—	—	8
	1928	—	—	—	—	—	—	—	—	8
	Mean	—	—	—	—	—	—	—	—	8
2·2+	1926	—	—	—	86.8 (22)	—	82.4 (7)	81.5 (17)	—	8
	1927	—	—	—	87.1 (8)	91.6 (10)	89.8 (5)	90.0 (5)	—	8
	1928	80.5 (4)	86.0 (1)	—	80.4 (5)	82.7 (19)	—	—	75.8 (4)	8
	1929	76.0 (1)	—	—	—	77.5 (2)	—	79.7 (3)	66.0 (1)	7
	1930	—	—	86.0 (1)	—	—	—	80.0 (2)	74.0 (4)	
	1931	79.5 (2)	79.7 (3)	80.0 (1)	84.3 (16)	82.6 (15)	—	82.7 (8)	77.8 (11)	8
	1932	—	—	—	—	81.7 (3)	—	85.0 (4)	—	8
	Mean	79.6 (7)	81.3 (4)	83.0 (2)	85.4 (51)	84.2 (49)	85.5 (12)	83.0 (39)	76.5 (20)	8
3·2+	1926	—	—	—	86.0 (18)	—	84.7 (3)	80.3 (11)	—	8
	1927	—	—	—	86.4 (17)	95.3 (21)	82.0 (1)	87.0 (8)	—	8
	1928	75.7 (15)	81.3 (6)	—	83.8 (10)	81.4 (36)	—	—	87.5 (2)	8
	1929	78.5 (8)	—	—	—	84.0 (3)	—	84.0 (5)	82.0 (2)	
	1930	80.3 (3)	81.9 (15)	80.2 (31)	—	—	—	83.0 (1)	81.7 (6)	
	1931	82.3 (22)	84.5 (4)	81.9 (12)	87.2 (57)	82.3 (30)	—	85.5 (17)	77.5 (8)	8
	1932	—	—	—	—	84.7 (6)	—	85.3 (3)	—	9
	Mean	79.5 (48)	82.2 (25)	80.7 (43)	86.5 (102)	85.0 (96)	84.0 (4)	84.3 (45)	80.5 (18)	8
4·2+	1926	—	—	—	72.0 (1)	—	—	—	—	
	1927	—	—	—	81.0 (1)	—	—	—	—	
	1928	77.3 (4)	86.0 (1)	—	91.0 (1)	—	—	—	—	
	1929	83.8 (6)	—	—	—	—	—	—	—	
	1930	74.5 (2)	80.5 (2)	—	—	—	—	—	84.0 (1)	
	1931	83.2 (6)	—	81.0 (2)	—	—	—	—	—	
	Mean	81.1 (18)	82.3 (3)	81.0 (2)	81.3 (3)	—	—	—	84.0 (1)	
5·2+	1931	84.0 (1)	—	—	—	—	—	—	—	
1·3+	1926	—	—	—	—	—	—	—	—	9
	1927	—	—	—	—	—	—	—	—	10
	1928	—	—	—	—	—	—	—	—	9
	1929	—	—	—	—	—	—	—	—	9
	1930	—	—	—	—	—	—	—	—	
	1931	—	—	—	—	—	—	—	—	
	1932	—	—	—	—	—	—	—	—	9
	Mean	—	—	—	—	—	—	—	—	9

[1]) In September.

(Table 29 continued).

Year	Kalix cm. (No.)	Lule cm. (No.)	Ume cm. (No.)	Ångerman cm. (No.)	Indal cm. (No.)	Ljung cm. (No.)	Ljusne cm. (No.)	Dal cm. (No.)	Mörrum cm. (No.)
926	—	—	—	98.2 (5)	—	102.8 (8)	99.4 (21)	—	100.8 (48)
927	—	—	—	104.5 (14)	104.6 (30)	104.1 (12)	95.1 (44)	—	99.1 (81)
928	97.1 (2)	—	—	101.5 (24)	103.8 (25)	—	—	93.1 (50)	101.9 (55)
929	96.5 (2)	97.3 (4)	—	—	98.4 (11)	—	97.4 (31)	95.4 (12)	93.1 (28)
930	104.8 (4)	100.1 (8)	96.7 (31)	—	—	—	102.1 (20)	95.8 (28)	—
931	103.5 (2)	115.5 (2)	100.0 (3)	101.7 (15)	102.1 (11)	—	103.0 (15)	95.9 (7)	98.0 (1)
932	—	—	—	—	100.0 (2)	—	104.7 (7)	—	99.0 (33)
Mean	101.3 (10)	101.5 (14)	97.0 (34)	102.0 (58)	103.0 (79)	103.6 (20)	98.6 (138)	94.4 (97)	99.4 (246)
926	—	—	—	103.6 (26)	—	99.4 (6)	98.3 (24)	—	98.0 (5)
927	—	—	—	104.5 (41)	105.5 (30)	100.8 (10)	96.7 (28)	—	98.8 (6)
928	96.1 (15)	97.2 (6)	—	102.3 (45)	106.4 (36)	—	—	93.5 (21)	104.3 (10)
929	97.1 (20)	95.4 (7)	—	—	96.1 (26)	—	103.1 (27)	108.5 (2)	92.0 (5)
930	99.4 (9)	99.4 (5)	96.6 (31)	—	—	—	101.1 (16)	96.8 (19)	—
931	102.4 (10)	106.0 (6)	99.1 (15)	102.8 (44)	101.5 (8)	—	101.2 (13)	99.8 (5)	—
932	—	—	—	—	97.0 (2)	—	106.4 (11)	—	103.3 (7)
Mean	98.2 (54)	99.3 (24)	97.4 (46)	103.2 (156)	102.9 (102)	100.3 (16)	100.5 (119)	96.1 (47)	99.8 (33)
926	—	—	—	103.0 (1)	—	—	—	—	—
927	—	—	—	—	101.0 (1)	—	—	—	—
928	—	110.0 (1)	—	99.0 (2)	—	—	—	94.1 (1)	—
929	97.9 (7)	98.4 (7)	—	—	108.0 (1)	—	110.0 (1)	—	—
930	94.0 (4)	104.0 (1)	95.3 (3)	—	—	—	—	—	—
931	98.0 (1)	—	—	—	—	—	—	—	—
932	—	—	—	—	103.0 (1)	—	99.0 (1)	—	—
Mean	96.6 (12)	100.3 (9)	95.3 (3)	100.3 (3)	104.0 (3)	—	104.5 (2)	94.0 (1)	—
926	—	—	—	100.0 (1)	—	120.0 (1)	110.5 (4)	—	102.0 (1)
927	—	—	—	—	—	110.0 (1)	—	—	—
928	—	—	—	119.7 (6)	120.0 (1)	—	—	103.5 (10)	—
929	—	115.0 (1)	—	—	119.0 (3)	—	108.3 (4)	107.0 (1)	114.4 (7)
930	108.5 (2)	120.0 (1)	119.8 (4)	—	—	—	117.0 (2)	114.7 (3)	—
931	—	118.0 (1)	113.0 (5)	117.8 (16)	116.5 (4)	—	112.2 (5)	111.0 (2)	115.0 (1)
932	—	—	—	—	—	—	116.0 (1)	—	—
Mean	108.5 (2)	117.7 (3)	116.0 (9)	117.5 (23)	117.9 (8)	115.0 (2)	111.6 (16)	106.8 (16)	113.1 (9)
926	—	—	—	118.4 (5)	—	—	109.5 (2)	—	—
927	—	—	—	121.0 (2)	114.5 (2)	—	90.0 (1)	—	—
928	115.0 (1)	114.0 (1)	—	107.3 (4)	118.3 (3)	—	—	106.6 (7)	—
929	112.6 (8)	108.7 (6)	—	—	132.0 (1)	—	104.4 (11)	107.5 (2)	—
930	109.3 (6)	109.5 (4)	119.8 (5)	—	—	—	102.0 (1)	111.0 (2)	—
931	116.0 (3)	117.5 (2)	—	116.0 (1)	119.5 (2)	—	106.0 (2)	100.0 (1)	—
Mean	112.2 (18)	110.7 (13)	119.8 (5)	114.9 (12)	119.4 (8)	—	104.2 (17)	106.9 (12)	—
928	—	—	—	113.0 (1)	—	—	—	—	—
929	116.0 (1)	98.0 (1)	—	—	—	—	110.0 (1)	—	—
926	—	—	—	127.0 (1)	—	—	—	—	—
931	—	—	—	—	122.0 (1)	—	—	—	—
932	—	—	—	—	—	—	125.0 (1)	—	—

Table 30. Length of se

Sp. = Spr

Age	Year	Obbola (Summer) cm. (No.)	Täfteå (Summer) cm. (No.)	Holmön (Summer) cm. (No.)	Ulvöarna (Summer) cm. (No.)	Bremön (Summer-Autumn) cm. (No.)	Alnön (Summer) cm. (No.)	Gnarp (Spring-Summe cm. (No.)
2·+	1930	—	—	—	—	41.8 (8)	—	—
	1931	—	—	—	—	37.3 (7)	—	—
	Mean	—	—	—	—	39.7 (15)	—	—
3·+	1930	—	—	—	—	40.0 (9)	—	—
	1931	—	—	—	—	36.2 (10)	—	—
	Mean	—	—	—	—	38.0 (19)	—	—
4·+	1930	—	—	—	—	41.0 (3)	—	—
1·1+	1931	—	—	—	70.0 (1) A.	—	—	—
2·1+	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	—	47.5 (2)	—	—	—	—	46.7 (9)
	1931	—	51.8 (73)	—	68.1 (22) A.	49.7 (27)	—	51.6 (7)
	1932	—	49.0 (4)	—	—	—	—	—
	1933	—	—	—	—	—	—	—
	Mean	—	51.5 (79)	—	68.1 (22)	49.7 (27)	—	48.8 (16)
3·1+	1925	—	—	—	—	—	—	—
	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	—	51.0 (9)	—	—	—	—	42.5 (4)
	1931	—	54.1 (61)	—	69.5 (10) A.	52.4 (32)	—	51.0 (3)
	1932	—	57.0 (17)	—	—	58.0 (2)	—	—
	Mean	—	54.3 (87)	—	69.5 (10)	52.7 (34)	—	46.1 (7)
4·1+	1930	—	—	—	—	—	—	44.5 (2)
	1931	—	52.5 (6)	—	—	50.0 (2)	—	—
	1932	—	—	—	—	—	—	—
	1933	—	—	—	—	—	—	—
	Mean	—	52.5 (6)	—	—	50.0 (2)	—	44.5 (2)
5·1+	1931	—	—	—	—	—	—	—
2·2+	1925	—	—	—	—	—	—	—
	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	80.0 (3)	75.0 (2)	—	—	—	—	68.0 (2)
	1931	77.8 (8)	84.6 (24)	83.5 (4)	—	80.1 (4)	84.8 (6)	70.5 (2)
	1932	—	75.0 (2)	93.0 (3)	—	73.0 (2)	—	76.0 (8)
	1933	—	—	—	—	—	—	—
	Mean	78.4 (11)	83.2 (28)	87.6 (7)	—	77.7 (6)	84.8 (6)	73.8 (12)

of various age groups.
A. = Autumn.

Öland	Pukaviken	Karlshamn	Hanöbukten	Simrishamn	Malmöhus (Spring)	Bornholm
cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	77.3 (3)A.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	46.6 (26)	—
—	—	81.4 (28)A.	—	—	47.7 (29)	—
—	—	—	—	—	42.5 (6)	—
—	—	—	—	47.0 (2)Sp.	49.0 (2)	—
—	—	81.0 (31)	—	47.0 (2)	46.8 (63)	—
—	—	—	—	—	—	—
—	—	77.8 (8)A.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	42.0 (7)	—
—	—	—	—	—	46.9 (106)	—
—	—	78.0 (33)A.	—	—	48.3 (100)	—
—	—	—	—	49.3 (13)Sp.	46.0 (33)	—
—	—	78.0 (41)	—	49.3 (13)	47.2 (246)	—
—	—	—	—	—	47.1 (7)	—
—	—	76.9 (4)A.	—	—	46.5 (11)	—
—	—	—	—	—	48.0 (21)	—
—	—	—	—	—	44.3 (3)	—
—	—	76.9 (4)	—	—	47.2 (42)	—
—	—	—	—	—	44.0 (1)	—
—	75.2 (5)	—	—	—	—	—
—	—	79.6 (15)Sp. 95.2 (5)A.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	76.3 (41)	—
—	—	—	—	—	75.8 (14)	—
—	—	80.0 (10)Sp. 97.8 (6)A.	—	—	78.3 (22)	—
—	—	—	75.6 (7)Sp.	87.8 (14)Sp.	84.4 (19)	88.7 (12)Sp.
—	—	—	—	81.3 (18)Sp.	73.3 (15)	—
—	75.2 (5)	85.0 (36)	75.6 (7)	84.1 (32)	77.9 (111)	88.7 (12)

Age	Year	Obbola (Summer) cm. (No.)	Täfteå (Summer) cm. (No.)	Holmön (Summer) cm. (No.)	Ulvöarna (Summer) cm. (No.)	Bremön (Summer-Autumn) cm. (No.)	Alnön (Summer) cm. (No.)	Gnarp (Spring-Summe cm. (No.)
3·2+	1925	—	—	—	—	—	—	—
	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	81.7 (15)	77.5 (10)	—	—	—	90.0 (1)	73.3 (6)
	1931	82.0 (27)	84.1 (54)	84.5 (57)	—	74.3 (3)	85.5 (6)	81.0 (6)
	1932	—	79.0 (27)	86.3 (30)	—	79.5 (4)	—	77.8 (15)
	1933	—	—	—	—	—	—	—
	Mean	81.9 (42)	81.9 (91)	85.1 (87)	—	77.3 (7)	86.1 (7)	77.5 (27)
4·2+	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	86.0 (1)	—	—	—	—	—	—
	1931	88.0 (1)	85.2 (5)	84.9 (13)	—	81.0 (1)	—	—
	1932	—	83.0 (8)	88.9 (7)	—	79.5 (2)	—	—
	1933	—	—	—	—	—	—	—
	Mean	87.0 (2)	83.8 (13)	86.3 (20)	—	80.0 (3)	—	—
5·2+	1932	—	—	—	—	—	—	—
2·3+	1925	—	—	—	—	—	—	—
	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	96.4 (11)	98.0 (3)	—	—	—	107.0 (7) Su.	100.0 (3)
	1931	—	104.2 (6)	101.5 (8)	—	—	104.0 (3)	—
	1932	—	113.0 (1)	102.5 (4)	—	—	—	98.8 (4)
	1933	—	—	—	—	—	—	—
	Mean	96.4 (11)	103.2 (10)	101.8 (12)	—	—	106.1 (10)	99.3 (7)
3·3+	1925	—	—	—	—	—	—	—
	1926	—	—	—	—	—	—	—
	1927	—	—	—	—	—	—	—
	1928	—	—	—	—	—	—	—
	1929	—	—	—	—	—	—	—
	1930	92.9 (8)	97.8 (12)	—	—	—	106.0 (2)	—
	1931	98.3 (23)	102.5 (32)	100.3 (55)	—	—	107.8 (4)	—
	1932	—	103.0 (17)	105.8 (35)	—	104.7 (3)	—	—
	Mean	96.9 (31)	101.7 (61)	102.4 (90)	—	104.7 (3)	107.2 (6)	—
4·3+	1930	—	—	—	—	—	89.0 (1)	—
	1931	—	—	101.0 (5)	—	—	—	—
	1932	—	105.0 (5)	102.0 (6)	—	—	—	107.7 (3
	Mean	—	105.0 (5)	101.5 (11)	—	—	89.0 (1)	107.7 (3
2·4+	1925	—	—	—	—	—	—	—
	1930	—	—	—	—	—	—	—
	1931	112.7 (3)	121.5 (2)	115.0 (1)	—	—	120.0 (3)	—
	Mean	112.7 (3)	121.5 (2)	115.0 (1)	—	—	120.0 (3)	—
3·4+	1930	109.0 (2)	110.0 (1)	—	—	—	113.7 (3)	—
	1931	—	116.5 (8)	112.7 (3)	—	—	123.0 (2)	—
	1932	—	121.0 (1)	—	—	—	—	—
	Mean	109.0 (2)	116.3 (10)	112.7 (3)	—	—	117.4 (5)	—
3·5+	1931	—	—	122.0 (1)	—	—	—	—

Öland	Pukaviken	Karlshamn	Hanöbukten	Simrishamn	Malmöhus (Spring)	Bornholm
cm. (Nr.)	cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)	cm. (No.)
—	76.8 (11)	—	—	—	—	—
—	—	79.1 (37)Sp. 95.5 (2)A.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	76.7 (59)	—
—	—	—	—	—	77.3 (28)	—
—	—	81.7 (19)Sp. 98.6 (14)A.	—	—	80.2 (63)	—
78.7 (11)Sp.	—	—	78.2 (24)Sp.	84.4 (26)Sp.	82.8 (41)	89.6 (20)
—	—	—	—	80.4 (65)Sp.	78.4 (38)	—
78.7 (11)	76.8 (11)	84.0 (72)	78.2 (24)	81.5 (91)	79.1 (229)	89.6 (20)
—	—	77.0 (1)Sp.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	82.2 (4)	—
—	—	—	—	—	82.0 (3)	—
—	—	86.3 (3)Sp. 94.0 (1)A.	—	—	79.4 (7)	—
—	—	—	—	86.3 (9)Sp.	86.8 (17)	90.2 (10)
—	—	—	—	79.0 (3)Sp.	82.6 (5)	—
—	—	84.4 (5)	—	84.5 (12)	83.8 (36)	90.2 (10)
—	—	—	82.0 (1)	—	78.0 (1)	—
—	95.9 (15)	—	—	—	—	—
—	—	95.1 (10)Sp.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	103.0 (4)	—
—	—	—	—	—	—	—
—	—	115.5 (2)A.	—	—	—	—
109.7 (9)Sp.	—	—	—	112.2 (4)Sp.	108.3 (3)	107.3 (10)
—	—	—	—	103.0 (4)Sp.	—	—
109.7 (9)	95.9 (15)	98.5 (12)	—	107.6 (8)	105.2 (7)	107.3 (10)
—	97.0 (6)	—	—	—	—	—
—	—	109.0 (3)Sp. 120.0 (1)A.	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	99.0 (3)	—
—	—	—	—	—	101.4 (5)	—
—	—	101.0 (1)	—	—	—	—
100.0 (2)Sp.	—	—	—	109.8 (26)Sp.	103.2 (6)	105.6 (61)
100.0 (2)	97.0 (6)	109.6 (5)	—	109.8 (26)	101.7 (14)	105.6 (61)
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	107.8 (5)Sp.	112.7 (3)	107.1 (18)Sp.
—	—	—	—	107.8 (5)	112.7 (3)	107.1 (18)
—	116.0 (3)	—	—	—	—	—
—	—	—	—	—	120.0 (1)	—
—	—	121.0 (1)	—	—	—	—
—	116.0 (3)	121.0 (1)	—	—	120.0 (1)	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—

Table 31. The Ratio

River	Year	31—35	36—40	41—45	46—50	51—55	56—60	61—65	66—70	71—75
Norrbotten										
Kalix	1929	—	—	—	—	—	—	—	—	3.75 (4)
—	1930	—	—	—	—	1.5 (2)	1.89 (11)	2.5 (6)	—	3.8 (2)
—	1931	—	—	—	—	2.0 (1)	2.75 (2)	2.5 (1)	3.75 (2)	4.0 (2)
	Mean	—	—	—	—	1.67 (3)	2.02 (13)	2.5 (7)	3.75 (2)	3.83 (8)
Lule	1930	—	—	—	2.1 (5)	2.42 (6)	2.23 (22)	2.93 (15)	—	5.0 (1)
Västerbotten										
Ume	1930	—	—	—	—	—	2.0 (1)	5.5 (1)	6.5 (2)	5.75 (4)
Västernorrland										
Ångerman	1926	—	—	—	—	—	—	3.1 (2)	3.5 (2)	5.0 (1)
—	1927	—	—	—	—	—	—	—	—	5.77 (3)
—	1928	—	—	—	—	—	—	—	—	8.5 (2)
—	1931	—	—	—	—	—	2.24 (5)	2.66 (3)	3.1 (1)	4.83 (4)
	Mean	—	—	—	—	—	2.24 (5)	2.84 (5)	3.37 (3)	5.86 (10)
Jämtland										
Indal	1927	—	—	—	—	—	—	—	—	—
—	1928	—	—	—	—	1.3 (1)	1.55 (2)	—	—	4.06 (8)
—	1929	—	—	—	—	1.3 (1)	1.55 (2)	—	—	3.25 (2)
—	1931	—	—	—	—	—	—	—	—	4.25 (2)
	Mean	—	—	—	—	1.3 (2)	1.55 (4)	—	—	3.96 (12)
Gävleborg										
Ljusne	1926	—	—	—	—	—	—	—	2.5 (6)	3.61 (3)
—	1927	—	—	—	—	—	2.3 (1)	—	—	—
—	1929	—	—	—	—	—	—	4.4 (1)	—	7.5 (1)
—	1931	—	—	—	—	4.3 (1)	2.6 (1)	2.8 (1)	3.5 (1)	5.85 (2)
—	1932	—	—	—	—	—	—	—	—	—
	Mean	—	—	—	—	4.3 (1)	2.45 (2)	3.6 (2)	2.64 (7)	4.09 (16)
Blekinge										
Mörrum	1926	—	—	—	—	1.5 (1)	2.43 (3)	2.92 (6)	3.33 (3)	4.75 (2)
—	1927	0.4 (1)	—	1.0 (8)	1.34 (8)	1.65 (4)	2.34 (11)	2.78 (4)	3.3 (2)	4.0 (1)
—	1928	—	—	—	1.3 (4)	1.89 (7)	2.04 (8)	2.82 (5)	4.0 (3)	—
—	1929	—	—	—	—	—	—	—	4.3 (1)	—
—	1932	—	—	—	—	—	—	—	—	—
	Mean	0.4 (1)	—	1.0 (8)	1.33 (12)	1.78 (12)	2.24 (22)	2.85 (15)	3.66 (9)	4.5 (3)
Västerbotten										
Täfteå, Summer	1931	—	—	1.0 (3)	1.0 (15)	1.09 (11)	1.78 (9)	2.56 (8)	3.03 (4)	4.07 (7)
— —	1932	—	—	—	2.76 (7)	1.33 (4)	1.68 (9)	2.28 (4)	3.3 (3)	3.77 (3)
Obbola, Summer	1930	—	—	—	—	—	—	—	—	5.0 (1)
— —	1931	—	—	—	—	—	—	—	—	3.0 (1)
	Mean	—	—	—	—	—	—	—	—	4.0 (2)
Holmön, Summer	1931	—	—	—	—	—	—	—	—	—
— —	1932	—	—	—	—	—	—	—	—	6.0 (1)
	Mean	—	—	—	—	—	—	—	—	6.0 (1)
Västernorrland										
Bremön, Summer	1931	0.41 (1)	0.7 (2)	0.8 (1)	—	—	1.57 (6)	2.03 (3)	—	3.27 (3)
Gävleborg										
Gnarp, Spring	1932	—	0.4 (1)	0.5 (1)	1.5 (1)	2.7 (1)	3.35 (2)	3.0 (1)	3.75 (2)	4.03 (3)
Gotland										
Spring	1932	—	0.5 (1)	—	—	—	—	—	3.3 (1)	4.29 (9)
Autumn	1932	—	—	—	—	—	—	—	2.9 (4)	4.3 (6)
	Mean	—	0.5 (1)	—	—	—	—	—	2.98 (5)	4.29 (15)
Blekinge										
Karlshamn, Spring	1926	—	—	—	—	—	—	—	2.75 (2)	3.56 (12)

ght (kg.).

86—90	91—95	96—100	101—105	106—110	111—115	116—120	121—125	126—130	131—135
6.0 (3)	8.65 (10)	10.83 (12)	12.06 (8)	16.0 (3)	16.17 (3)	17.75 (2)	—	—	—
8.0 (2)	9.0 (3)	11.15 (6)	12.83 (6)	13.5 (6)	16.33 (3)	19.0 (3)	—	—	—
7.63 (8)	8.33 (3)	11.5 (4)	12.71 (7)	14.5 (2)	16.0 (1)	17.0 (2)	—	—	—
7.31 (13)	8.66 (16)	11.04 (22)	12.5 (21)	14.36 (11)	16.21 (7)	18.07 (7)	—	—	—
8.0 (2)	10.5 (6)	12.0 (7)	13.33 (6)	15.0 (1)	16.0 (2)	19.0 (3)	—	—	—
8.13 (10)	9.76 (26)	11.07 (26)	11.86 (7)	13.28 (5)	15.33 (3)	17.0 (2)	18.27 (3)	—	—
7.2 (53)	9.05 (17)	10.25 (15)	12.32 (24)	13.39 (29)	14.87 (17)	17.35 (14)	19.8 (2)	21.91 (8)	—
7.06 (15)	8.25 (11)	9.91 (35)	11.26 (43)	12.58 (23)	14.45 (13)	16.73 (3)	10.5 (1)	21.0 (2)	—
6.95 (12)	8.70 (23)	10.16 (34)	12.8 (55)	12.75 (32)	14.92 (12)	16.5 (4)	20.0 (2)	—	22.5 (4)
7.07 (31)	7.33 (20)	11.04 (17)	11.91 (27)	13.7 (21)	15.41 (15)	17.58 (6)	19.55 (6)	20.0 (1)	—
7.12 (111)	8.33 (71)	10.24 (101)	12.12 (149)	12.96 (105)	14.93 (57)	17.20 (27)	18.85 (11)	21.57 (11)	22.5 (4)
7.0 (25)	8.42 (17)	9.51 (38)	10.66 (49)	12.5 (36)	15.19 (21)	16.81 (19)	—	—	—
6.85 (10)	7.98 (12)	9.88 (32)	10.48 (32)	12.46 (27)	14.91 (28)	15.85 (10)	20.0 (4)	26.0 (2)	—
6.85 (6)	7.86 (8)	9.27 (7)	10.98 (4)	10.0 (2)	16.1 (1)	13.5 (1)	—	—	—
7.02 (13)	9.86 (5)	10.78 (9)	12.21 (7)	14.42 (6)	16.83 (3)	18.0 (1)	19.75 (2)	23.5 (2)	—
6.96 (54)	8.36 (42)	9.76 (86)	10.47 (92)	12.58 (71)	15.15 (53)	16.43 (31)	19.92 (6)	24.75 (4)	—
7.09 (20)	9.01 (15)	10.58 (31)	12.57 (28)	13.27 (28)	14.4 (9)	14.0 (6)	—	—	—
8.31 (12)	8.48 (21)	10.90 (60)	11.84 (42)	13.61 (21)	14.9 (5)	15.6 (2)	14.8 (2)	20.0 (2)	—
7.03 (3)	9.09 (12)	10.33 (22)	11.66 (27)	13.61 (17)	14.73 (3)	—	18.0 (1)	19.5 (1)	—
7.11 (7)	9.22 (6)	10.53 (11)	13.0 (9)	14.2 (13)	16.48 (6)	17.9 (1)	—	—	—
8.25 (2)	8.8 (2)	10.95 (4)	11.93 (6)	14.58 (4)	15.05 (4)	15.86 (5)	20.0 (2)	—	—
7.48 (44)	8.82 (56)	10.7 (128)	11.75 (112)	13.63 (83)	15.09 (27)	15.17 (14)	17.52 (5)	19.83 (3)	—
7,2 (11)	9.0 (9)	10.33 (35)	10.43 (7)	14.06 (8)	14.5 (1)	18.0 (2)	—	—	—
6.62 (13)	8.71 (22)	9.2 (60)	9.65 (10)	12.17 (12)	16.0 (1)	14.0 (1)	—	—	—
6.75 (8)	7.67 (3)	8.73 (37)	10.06 (17)	11.55 (11)	12.5 (4)	14.25 (2)	—	—	—
8.59 (17)	10.5 (6)	10.89 (9)	12.5 (2)	14.3 (6)	13.0 (1)	—	—	14.0 (1)	16.5 (1)
7.0 (28)	8.32 (19)	9.28 (25)	11.04 (24)	12.57 (7)	16.5 (2)	13.0 (1)	—	—	—
7.29 (77)	8.74 (59)	9.44 (166)	10.51 (60)	12.71 (44)	14.06 (9)	15.25 (6)	—	14.0 (1)	16.5 (1)
6.87 (19)	8.19 (12)	10.33 (9)	12.03 (20)	12.0 (1)	15.92 (6)	19.5 (3)	20.0 (3)	—	—
6.68 (6)	7.85 (2)	12.0 (2)	11.98 (12)	14.43 (3)	15.65 (6)	—	19.5 (1)	—	—
8.0 (6)	10.0 (10)	11.0 (8)	12.0 (2)	15.5 (2)	—	—	—	—	—
8.0 (8)	9.8 (5)	10.89 (9)	12.2 (10)	15.33 (3)	19.0 (1)	20.0 (1)	—	—	—
8.0 (14)	9.93 (15)	10.94 (17)	12.17 (12)	15.4 (5)	19.0 (1)	20.0 (1)	—	—	—
8.1 (32)	9.1 (12)	11.0 (23)	12.4 (26)	14.0 (8)	16.2 (6)	21.0 (2)	19.5 (2)	—	—
7.16 (16)	8.63 (8)	9.83 (9)	12.33 (18)	12.17 (9)	14.75 (8)	14.5 (2)	—	—	—
7.55 (48)	9.05 (20)	10.67 (32)	12.39 (44)	13.03 (17)	15.36 (14)	17.75 (4)	19.5 (2)	—	—
6.4 (1)	—	9.1 (1)	—	—	—	—	—	—	—
8.7 (2)	—	11.29 (7)	11.37 (3)	14.5 (1)	15.9 (2)	—	—	19.5 (1)	—
6.15 (8)	7.3 (2)	10.5 (7)	12.42 (6)	14.55 (4)	15.8 (1)	12.7 (1)	—	—	—
7.9 (5)	9.47 (6)	11.46 (12)	13.2 (12)	15.58 (4)	17.43 (3)	—	—	—	—
6.82 (13)	8.95 (8)	11.11 (19)	12.94 (18)	15.06 (8)	17.03 (4)	12.7 (1)	—	—	—
6.08 (5)	9.38 (4)	10.3 (7)	10.6 (2)	13.0 (1)	—	—	20.2 (1)	—	—

Table 32. Percentage and number o

Sea district	Year	·+	·1+	·2+	·3+	·4+	·5+	·6
Västerbotten								
Obbola, Summer	1930	—	—	47.5 (19)	47.5 (19)	5.0 (2)	—	—
— —	1931	—	—	58.1 (36)	37.1 (23)	4.8 (3)	—	—
	Mean	—	—	53.9 (55)	41.2 (42)	4.9 (5)	—	—
Täfteå, Summer	1930	—	28.2 (11)	30.8 (12)	38.5 (15)	2.5 (1)	—	—
— —	1931	—	51.7 (140)	30.7 (83)	14.0 (38)	3.6 (10)	—	—
— —	1932	—	24.7 (21)	47.1 (40)	27.0 (23)	1.2 (1)	—	—
	Mean	—	43.5 (172)	34.2 (135)	19.2 (76)	3.0 (12)	—	—
Holmön, Summer	1931	—	—	50.3 (74)	46.3 (68)	2.7 (4)	0.7 (1)	—
— —	1932	—	—	47.1 (40)	52.9 (45)	—	—	—
	Mean	—	—	49.1 (114)	48.7 (113)	1.7 (4)	0.4 (1)	—
Västernorrland								
Ulvöarna, Autumn	1931	—	97.1 (33)	2.9 (1)	—	—	—	—
Bremön, Autumn	1930	95.2 (20)	4.8 (1)	—	—	—	—	—
— Summer	1931	—	87.1 (61)	11.4 (8)	1.4 (1)	—	—	—
— Autumn	1931	94.4 (17)	5.5 (1)	—	—	—	—	—
— Spring	1932	—	21.4 (3)	57.1 (8)	21.4 (3)	—	—	—
	Mean	30.1 (37)	53.7 (66)	13.0 (16)	3.2 (4)	—	—	—
Alnön, Summer	1930	—	—	13.3 (2)	60.0 (9)	26.7 (4)	—	—
— —	1931	—	—	50.0 (12)	29.2 (7)	20.8 (5)	—	—
	Mean	—	—	35.9 (14)	41.0 (16)	23.1 (9)	—	—
Gävleborg								
Gnarp, Summer	1930	—	60.0 (15)	32.0 (8)	8.0 (2)	—	—	—
— Spring	1931	—	52.6 (10)	42.1 (8)	5.3 (1)	—	—	—
— —	1932	—	5.3 (2)	63.2 (24)	31.5 (12)	—	—	—
	Mean	—	32.9 (27)	48.8 (40)	18.3 (15)	—	—	—
Upsala								
Grisslehamn, Spring	1931	—	82.4 (14)	17.6 (3)	—	—	—	—
Gotland								
Spring	1932	—	3.1 (2)	73.1 (48)	23.8 (15)	—	—	—
Autumn	1932	—	45.8 (38)	54.2 (45)	—	—	—	—
	Mean	—	27.0 (40)	62.9 (93)	10.1 (15)	—	—	—

VI.

Summary.

The smolt age in the Swedish rivers varies between 1—5 year and is generally highest in the more northerly districts. According to literary and other information the same conditions obtain in the other rivers entering the south and east Baltic and the Bay of Bothnia. This age at migration increasing with latitude is due probably firstly to the poorer growth in the north and the tendency of fish to migrate in reaching a definite size. The sea age of maiden salmon is for the Swedish rivers from 1—5 winters. For the time of residence in river and sea an inverse ratio prevails. The total age at first spawning migration is from 3 to 8 years. The growth, and thus the length and weight, at a given age varies according to rivers and can probably be considered to a certain extent as an inheritive peculiarity.

Of the fish caught in the rivers some 7.5 and of sea fish on the Swedish coast some 3.2 are mended kelts.

The fishing returns for salmon for the wh Baltic amount yearly to about 1,300 tons, of wh by weight, ⅔ come from the sea and ⅓ from rivers, whilst the proportion in number is resp 4 to 1 due to the intense catch of small salmo the sea.

Swedish river fish migrate during their winter to the south-western parts of the Ba They remain partly here before returning to t spawning rivers, but partly with increased age d towards the south-eastern part of the Baltic f whence they start their migration.

Salmon from the north Finnish rivers mig during the first winter to the south-eastern B

the sea of 0.8 to 6 winters.

district	Year	·+	·1+	·2+	·3+	·4+	·5+	·6	Total number
ging	1933	—	—	47.8 (11)	47.8 (11)	4.4 (1)	—	—	23
Spring	1926	—	—	80.3 (53)	19.7 (13)	—	—	—	66
Autumn	1926	—	57.9 (11)	36.8 (7)	5.3 (1)	—	—	—	19
Spring	1931	—	—	94.2 (32)	2.9 (1)	2.9 (1)	—	—	34
Autumn	1931	—	73.9 (65)	23.9 (21)	2.3 (2)	—	—	—	88
	Mean	—	36.7 (76)	54.6 (113)	8.2 (17)	0.5 (1)	—	—	207
Spring	1925	—	2.3 (1)	37.2 (16)	48.8 (21)	11.6 (5)	—	—	43
n, Spring	1932	—	—	100.0 (33)	—	—	—	—	33
n, Spring	1932	—	15.0 (15)	49.0 (49)	35.0 (35)	1.0 (1)	—	—	100
—	1933	—	5.4 (5)	90.2 (83)	4.3 (4)	—	—	—	92
	Mean	—	10.4 (20)	68.7 (132)	20.3 (39)	0.5 (1)	—	—	192
Places, Spring	1929	—	5.9 (7)	88.2 (104)	5.9 (7)	—	—	—	118
— —	1930	—	72.4 (139)	24.0 (46)	3.1 (6)	0.5 (1)	—	—	191
— —	1931	—	60.5 (141)	39.5 (92)	—	—	—	—	233
— —	1932	—	40.0 (60)	52.0 (78)	8.0 (12)	—	—	—	150
— —	1933	—	8.9 (6)	86.6 (58)	3.0 (2)	1.5 (1)	—	—	67
	Mean	—	46.4 (353)	49.7 (378)	3.6 (27)	0.3 (2)	—	—	760
pring	1932	—	—	31.9 (42)	67.4 (89)	0.7 (1)	—	—	132
.....	1925	—	—	17.0 (17)	63.0 (63)	20.0 (20)	—	—	100
.....	1928	—	—	33.0 (33)	65.0 (65)	2.0 (2)	—	—	100
	Mean	—	—	25.0 (50)	64.0 (128)	11.0 (22)	—	—	200
.....	1929	—	—	3.9 (5)	14.2 (18)	33.1 (42)	33.1 (42)	15.7 (20)	127

salmon of at least 2 winters.
ier 1 spec. of 7 and 1 spec. of 10 winters.

remain there until their time of re-migration. non from the south Finnish, Esthonian, Latvian, man and Polish rivers of which the Esthonian Latvian are the larger and the most important uantity, remain, generally, near their own rivers. reasons for these variations in migration are search for more southerly and, to a certain nt, shallower waters containing richer feeding lities as well as probably higher salinity and mer temperature. Certain years when the perature is high a number of salmon remain on northern coasts and even young salmon migrate e from the Esthonian, Latvian and south Fin- rivers.

Fisheries in the southern Baltic of south Sweden, nholm, Germany and Poland are based on non originating from the Swedish and Finnish rs and show, on the whole, the same variations ishery returns as the salmon fisheries of the hern districts and rivers of the Baltic.

The large catches of small salmon, especially those in the southern Baltic, should be prevented, for preference through the introduction of a minimum size of 60 cm. The economic gain from this would be approximately 250,000 crowns per annum.

Salmon fishery in the rivers and estuaries should be limited by the lengthening of the period of prohibited fishing and weekly holidays and by avoiding the capture of parr and smolt.

Artificial hatching should be supported by a contributive compensation for the damage done by industry and eventually practised in other rivers. Other measures might also be considered for increasing the production of salmon, and to these and other measures all the southern Baltic States should be a party.

A convention relating to measures for the protection and increase of the salmon population should be entered into between the different Baltic States.

Table 33. Average monthly temperature of the water of the Baltic at (Bothnian Sea), III: at Öland's Re

January

	I		II		III		IV	
	0	5	0	5	0	5	0	5
1923 ...	—	—	1.9	—	3.1	—	3.1	3.2
24 ...	—	—	1.8	1.6	2.0	2.0	0.2	0.3
25 ...	—	—	3.2	3.2	3.8	3.8	4.2	4.3
26 ...	—	—	0.6	0.6	2.0	2.1	2.0	2.0
27 ...	—	—	1.4	1.4	2.9	2.8	3.5	3.5
28 ...	—	—	0.1	0.1	1.8	1.8	0.6	0.7
29 ...	—	—	2.6	2.5	2.9	3.0	2.0	2.1
1930 ...	—	—	4.0	4.0	4.4	4.4	3.8	3.8
31 ...	—	—	2.8	2.7	3.5	3.5	3.2	3.3
32 ...	—	—	2.0	2.0	3.0	3.0	2.8	2.8
Mean...	—	—	2.0	2.0	2.9	2.9	2.5	2.6

February

	I		II		III		IV	
	0	5	0	5	0	5	0	5
1923 ...	—	—	—	—	1.6	—	1.6	1.7
24 ...	—	—	—	—	1.3	1.4	—0.1	0.0
25 ...	—	—	2.2	2.2	3.2	3.3	3.6	3.6
26 ...	—	—	—	—	1.3	1.3	0.9	0.9
27 ...	—	—	0.8	0.8	1.9	1.9	2.2	2.3
28 ...	—	—	—	—	1.4	1.3	1.0	1.0
29 ...	—	—	0.7	0.9	1.0	1.1	0.3	0.5
1930 ...	—	—	2.7	2.7	2.8	2.9	2.2	2.3
31 ...	—	—	0.4	0.4	2.1	2.1	1.2	1.3
32 ...	—	—	1.1	1.1	1.7	1.7	1.7	1.8
Mean...	—	—	1.3	1.4	1.8	1.9	1.5	1.5

March

	I		II		III		IV	
	0	5	0	5	0	5	0	5
1923 ...	—	—	—	—	1.1	—	1.1	1.1
24 ...	—	—	—	—	—	—	—	—
25 ...	—	—	1.4	1.4	2.5	2.5	3.0	3.0
26 ...	—	—	—	—	1.0	1.1	1.8	1.8
27 ...	—	—	0.5	0.5	1.9	1.8	2.8	2.8
28 ...	—	—	—	—	1.1	1.1	1.1	1.1
29 ...	—	—	—	—	—	—	1.0	1.0
1930 ...	—	—	2.0	2.1	2.5	2.5	2.5	2.3
31 ...	—	—	—	—	1.0	1.1	0.6	0.6
32 ...	—	—	—	—	0.9	0.9	1.1	1.2
Mean...	—	—	1.3	1.3	1.5	1.6	1.7	1.7

April

	I		II		III		IV
	0	5	0	5	0	5	0
1923 ...	—	—	1.2	—	2.2	—	2.9
24 ...	—	—	—	—	1.2	1.2	1.7
25 ...	—	—	2.4	2.2	3.7	3.6	4.3
26 ...	—	—	1.1	1.0	1.8	1.8	3.9
27 ...	—	—	1.4	1.4	2.2	2.2	4.5
28 ...	—	—	1.5	1.4	2.1	2.1	3.1
29 ...	—	—	0.9	0.9	1.1	1.0	1.6
1930 ...	1.7	1.4	2.9	2.8	3.5	3.4	4.4
31 ...	—	—	—	—	1.5	1.5	2.4
32 ...	—	—	—	—	2.0	1.9	3.3
Mean...	1.7	1.4	1.6	1.6	2.1	2.1	3.2

May

	I		II		III		IV
	0	5	0	5	0	5	0
1923 ...	—	—	3.2	—	4.5	—	6.7
24 ...	—	—	2.9	2.8	3.5	3.5	4.8
25 ...	4.3	4.1	5.0	5.1	7.1	7.1	8.8
26 ...	—	—	3.3	3.3	4.6	4.4	8.1
27 ...	—	—	3.1	3.1	4.6	4.5	7.2
28 ...	3.5	3.4	3.9	3.6	4.6	4.5	7.0
29 ...	3.1	2.6	3.0	2.8	3.4	3.7	6.3
1930 ...	5.1	4.8	5.8	5.6	6.6	6.3	8.4
31 ...	4.1	3.9	3.2	3.0	4.3	4.2	6.6
32 ...	3.1	2.8	3.4	3.2	5.3	5.3	7.1
Mean...	3.9	3.6	3.7	3.6	4.9	4.8	7.1

June

	I		II		III		IV
	0	5	0	5	0	5	0
1923 ...	6.5	6.1	6.7	6.6	7.9	—	10.2
24 ...	5.9	5.8	7.3	6.9	7.8	7.4	10.2
25 ...	10.1	9.6	9.8	9.7	12.1	11.7	12.8
26 ...	7.5	6.9	7.9	7.3	10.0	9.4	13.1
27 ...	6.0	5.3	7.3	7.1	7.5	7.5	10.5
28 ...	5.6	5.1	6.4	6.0	7.7	7.6	10.5
29 ...	7.4	7.1	7.3	6.8	8.0	8.0	10.8
1930 ...	10.4	9.4	10.8	9.5	12.4	12.1	13.9
31 ...	6.4	6.3	7.2	6.9	8.2	8.2	11.8
32 ...	6.1	5.6	7.1	6.9	8.8	8.6	12.6
Mean...	7.2	6.7	7.8	7.4	9.0	8.9	11.6

ace and at 5 m. I: at Sydostbrotten (Gulf of Bothnia), II: at Svenska Björn at Falsterbo Reef.

July

	I		II		III		IV	
	0	5	0	5	0	5	0	5
...	12.5	11.7	13.8	12.7	12.3	—	14.2	13.2
...	13.0	11.0	13.2	12.3	11.5	11.2	14.0	13.8
...	17.0	16.2	17.3	16.1	17.0	16.5	16.9	16.8
...	14.4	13.9	15.7	14.1	16.3	16.1	17.2	17.0
...	15.8	12.0	15.8	12.6	14.2	13.3	15.5	15.0
...	10.6	10.0	11.1	11.0	10.3	10.1	13.7	13.5
...	10.8	10.5	11.0	10.7	12.0	11.7	13.9	13.5
...	15.7	15.2	16.7	16.0	16.2	16.1	16.3	16.2
...	12.2	12.5	11.5	11.2	11.5	11.1	15.1	14.9
...	14.1	12.3	16.1	14.4	17.1	16.7	17.6	17.4
...	13.6	12.5	14.2	13.1	13.8	13.6	15.4	15.1

August

	I		II		III		IV	
	0	5	0	5	0	5	0	5
...	13.0	12.9	13.7	13.5	12.2	—	12.9	12.9
...	16.9	16.6	17.1	16.8	15.9	15.6	15.7	15.7
...	16.2	16.1	15.8	15.7	17.2	17.2	17.3	17.3
...	16.3	16.3	15.7	15.7	15.0	14.3	16.6	16.5
...	15.0	14.2	18.0	17.2	16.5	16.4	17.2	17.2
...	12.5	12.5	12.3	12.8	11.7	11.3	14.5	14.5
...	12.7	13.1	13.5	13.4	12.6	11.6	14.4	14.9
...	15.3	14.9	17.6	17.5	16.5	16.4	16.1	16.0
...	14.6	14.5	14.1	13.8	12.8	12.5	15.9	15.9
...	14.6	14.3	15.8	15.5	17.1	17.4	16.6	16.1
...	14.7	14.5	15.4	15.2	14.8	14.7	15.7	15.7

September

	I		II		III		IV	
	0	5	0	5	0	5	0	5
...	10.2	10.2	10.7	10.5	8.3	8.2	11.5	11.6
...	14.1	14.0	12.1	11.9	10.8	10.6	14.2	14.4
...	12.9	13.0	14.0	14.1	14.1	14.1	14.1	14.1
...	9.2	9.2	11.4	11.4	10.9	10.4	13.0	12.8
...	10.1	10.2	13.6	13.6	13.0	13.5	14.4	14.5
...	11.7	11.6	12.0	12.1	13.1	13.1	14.4	14.4
...	10.9	11.0	12.1	10.9	11.4	10.9	14.4	14.5
...	8.8	9.9	13.3	13.5	14.9	14.9	14.7	14.7
...	9.3	9.6	10.4	10.3	12.0	12.0	13.2	13.2
...	9.6	9.5	12.7	12.7	11.0	10.9	14.2	14.1
...	10.7	10.8	12.2	12.1	12.0	11.9	13.8	13.8

October

	I		II		III		IV	
	0	5	0	5	0	5	0	5
1923 ...	8.3	8.3	8.5	8.5	8.4	8.4	10.6	10.7
24 ...	10.8	10.9	8.0	7.8	8.3	8.2	11.7	11.7
25 ...	4.5	4.9	7.8	7.9	10.2	10.2	10.2	10.7
26 ...	5.5	5.5	8.1	8.1	9.7	9.6	10.9	10.8
27 ...	7.8	7.7	8.3	8.4	7.5	7.6	10.2	9.8
28 ...	6.2	6.2	8.8	8.8	10.3	10.6	11.3	11.2
29 ...	8.2	8.2	8.3	8.2	9.3	9.3	11.7	11.8
1930 ...	5.8	6.1	9.0	9.4	11.3	11.3	12.4	12.4
31 ...	5.5	5.9	8.0	8.0	9.4	9.9	10.7	10.7
32 ...	7.5	7.5	7.8	7.9	8.7	8.7	11.2	11.2
Mean...	7.1	7.1	8.3	8.3	9.4	9.4	11.1	11.1

November

	I		II		III		IV	
	0	5	0	5	0	5	0	5
1923 ...	6.0	6.0	6.3	6.3	5.4	5.4	7.6	7.6
24 ...	6.4	6.5	5.0	5.1	6.8	6.8	8.2	8.2
25 ...	1.7	1.8	4.7	4.8	6.7	6.7	7.0	7.6
26 ...	2.8	2.9	5.4	5.5	6.8	6.9	7.6	7.7
27 ...	2.7	2.8	5.2	5.1	5.6	5.7	7.2	7.3
28 ...	3.6	3.6	7.1	7.2	7.9	8.0	9.0	8.8
29 ...	5.8	6.1	6.4	6.4	6.8	6.8	8.3	8.3
1930 ...	4.4	4.5	7.0	7.0	7.9	8.0	8.7	8.8
31 ...	3.4	3.5	5.4	5.5	7.2	7.1	8.1	8.1
32 ...	4.5	4.6	5.4	5.4	6.9	7.0	7.3	7.3
Mean...	4.1	4.2	5.8	5.8	6.8	6.8	7.9	8.0

December

	I		II		III		IV	
	0	5	0	5	0	5	0	5
1923 ...	—	—	4.2	4.2	3.9	3.9	4.2	4.2
24 ...	4.1	4.1	3.8	3.9	5.3	5.3	5.7	5.6
25 ...	—	—	2.1	2.1	3.7	3.7	3.0	3.1
26 ...	2.7	2.7	3.4	3.4	4.9	4.9	5.3	5.3
27 ...	1.1	1.8	2.4	2.5	3.3	3.4	2.3	2.3
28 ...	3.1	3.2	5.0	5.1	5.2	5.4	5.5	5.5
29 ...	4.8	4.9	5.3	5.3	5.3	5.4	6.1	6.1
1930 ...	3.1	3.1	5.0	4.9	5.3	5.3	6.1	6.1
31 ...	3.0	3.0	3.7	3.7	4.6	4.8	4.2	4.2
32 ...	3.8	3.8	4.1	4.0	5.2	5.3	5.2	5.2
Mean...	3.2	3.3	3.9	3.9	4.7	4.7	4.8	4.8

Literature.

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